CRANFIELD UNIVERSITY

GIORGIO CASELLI

OWNERSHIP STRUCTURE AND THE RISK-TAKING CHANNEL OF MONETARY POLICY TRANSMISSION

SCHOOL OF MANAGEMENT
PhD Programme

Doctor of Philosophy
Academic Year: 2016–2017

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This thesis is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy.

To my family, with love and gratitude

The improvement of understanding is for two ends:
first, our own increase of knowledge;
secondly, to enable us to deliver that knowledge to others.

—John Locke,
An Essay Concerning Human Understanding

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List of Abbreviations

ABS	Association of Business Schools
AR	AutoRegressive
BHC	Bank Holding Company
BIS	Bank for International Settlements
BRSS	Bank Regulation and Supervision Survey
BSA	Building Societies Association
CEE	Central and Eastern European
CeRBE	Center for Relationship Banking and Economics
CIMO	Context, Intervention, Mechanism and Outcome
CPI	Consumer Price Index
CSSI	Centre for Sustainable and Social Innovation
EACB	European Association of Cooperative Banks
ECB	European Central Bank
EFMA	European Financial Management Association
EONIA	Euro OverNight Index Average
ESRB	European Systemic Risk Board
FDICIA	Federal Deposit Insurance Corporation Improvement Act
FEBS	Financial Engineering and Banking Society
GDP	Gross Domestic Product
GFDD	Global Financial Development Database
GMM	Generalised Method of Moments
IFABS	International Finance And Banking Society
IFRS	International Financial Reporting Standards
IFS	International Financial Statistics
IRCCF	International Research Centre on Cooperative Finance

IS–LM	Investment/Savings–Liquidity/Money
LTV	Loan To Value
M&A	Merger and Acquisition
MMF	Money, Macro and Finance
MRO	Main Refinancing Operation
NOWA	Norwegian Overnight Weighted Average
OBS	Off-Balance Sheet
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
PLS	Panel Least Squares
R&R	Revise and Resubmit
REO	Real Estate Owned
SD	Standard Deviation
SLR	Systematic Literature Review
SONIA	Sterling OverNight Index Average
STIBOR	STockholm InterBank Offered Rate
WDI	World Development Indicators
WGI	Worldwide Governance Indicators

Abstract

Recent years have seen a growing interest in the implications of monetary policy for bank risk taking and financial stability. Yet, there has hitherto been limited attention on how ownership structure affects the relationship between monetary policy and bank risk. Drawing on three interconnected studies written as journal articles, this thesis provides novel insights into the role of banks in monetary policy transmission. First, it refines our understanding of the monetary transmission process via financial intermediaries. Based on a systematic review of 152 articles published during the 1963–2016 period, this research integrates a highly fragmented body of evidence into a multidimensional framework that combines the mechanisms of monetary transmission through financial institutions with the conditions underpinning the functioning of each mechanism. Second, this thesis incorporates concepts from the property rights and agency theory perspectives into the analysis of the risk-taking channel. By building a sample of commercial, cooperative and savings banks from 17 Western European countries over the 1999–2011 period, this study finds that the impact of lower interest rates on bank risk taking is reduced for stakeholder banks relative to their shareholder counterparts. Third, this research contributes to the current debate about how to design a more stable and resilient financial system by introducing diversity measures from ecological theories into the study of the monetary policy–bank risk nexus. After estimating the ownership composition of the banking sector in terms of relative market shares of shareholder banks vis-à-vis stakeholder banks, this work shows that the effects of unexpected monetary policy shocks on banks' probability of default is dampened in countries with greater ownership diversity. Taken together, these findings advance knowledge in this field of enquiry by highlighting the need to account for differences in ownership structures when assessing the implications of the monetary environment for bank riskiness.

Keywords

Bank risk taking; financial crisis; financial stability; monetary transmission mechanism; ownership diversity; systematic literature review.

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Chapter 1

Introduction

1.1 Research Background and Rationale

The global financial crisis that erupted in 2007 has arguably been the most severe market downturn since the Great Depression of the 1930s (Hodgson, 2009). Following the collapses of Lehman Brothers in the US and Northern Rock in the UK, the world was on the verge of an economic meltdown. Since the onset of the recent turmoil, the causes of the financial crisis and ensuing economic contraction have been at the centre of an intense academic and policy debate (Acharya and Naqvi, 2012). Many commentators have blamed the 'too-low-for-too-long' interest rate environment until the mid-2000s for changes in risk perception by banks and the build-up of risks in the economy via a 'risk-taking channel' of monetary transmission (Borio and Zhu, 2012). According to the literature (Angeloni et al., 2015; Ioannidou et al., 2015; Jiménez et al., 2014), there are two main channels through which monetary policy affects bank risk. The first mechanism is related to the asset structure of financial intermediaries' balance sheets. As Cociuba et al. (2016) suggest, a protracted period of relatively low interest rates encourages banks to search for yield by making risky assets more attractive than safe bonds. Inasmuch as financial intermediaries shift their investments towards riskier assets, a greater degree of procyclical risk taking is introduced in the financial system (Rajan, 2006) and an equilibrium with weakened bank portfolios, lower and more volatile profits and higher aggregate credit is realised (Dell'Ariccia and Marquez, 2006). The second mechanism underpinning the risk-taking channel operates via the impact of monetary policy on financial intermediaries' funding side. Since marginal funding costs

are reduced within an expansionary monetary environment, it is more profitable for banks to finance new loans by increasing leverage (Valencia, 2014). In light of this evidence, a related discussion has unfolded on whether continued expectations of exceptionally low interest rates are already sowing the seeds for the next financial crisis (Dell'Ariccia et al., 2013).

Triggered by the global financial turmoil, research on the role of financial intermediaries as conduits for monetary policy transmission has grown considerably during the last few years. This notwithstanding, the variety of topics addressed by the literature has made it difficult for researchers to build on each other's work, leading to a highly fragmented body of knowledge. The lack of an integrated view of the monetary transmission mechanism through financial intermediaries has hampered progress in the field, while leaving practitioners and policymakers with virtually no evidence that takes into account the system as a whole. Furthermore, there appears to be a paucity of studies on the extent to which monetary policy interacts with bank ownership in determining financial intermediaries' appetite for risk. Such a void is surprising, in that standard property rights (Alchian and Demsetz, 1972) and agency theory (Jensen and Meckling, 1976) perspectives point to ownership structure as a key factor explaining firms' risk taking. This gap is also at odds with the financial architecture of many Western European countries, in which profit-maximising banks (i.e. 'shareholder banks') compete alongside a large number of banks that strive to create value for a multiplicity of stakeholders (i.e. 'stakeholder banks'). In addition, despite the growing appreciation of the need to address risk at the systemic level (May and Arinaminpathy, 2010), little has hitherto been the attention on how the interactions between banks with different types of ownership influence financial stability. This seems to be inconsistent with insights from ecology, where the degree of diversity (or heterogeneity) of an ecosystem is known to have important effects on its stability (Tilman and Downing, 1994). Such a gap might also bear serious consequences from a policy standpoint, insofar as diversity of ownership structures

in banking could account for a differential impact of monetary policy on bank risk taking.

1.2 Research Aims and Objectives

Against this background, the aim of this thesis is to provide novel insights into the role of banks in monetary policy transmission. As will become clear hereinafter, banks play a central and multifaceted role within the monetary transmission mechanism, that is, the process through which monetary policy decisions influence real output and inflation (Taylor, 1995). The overarching research question that is addressed in this work refers to the extent to which ownership structure affects monetary transmission via the risk-taking channel. Support exists in the literature for the role of banks' ownership type in influencing their behaviour, performance and ultimate survival (Fama and Jensen, 1983; O'Hara, 1981; Rasmusen, 1988). Whereas commercial banks have maximisation of shareholder wealth as their main objective, cooperative and savings banks aim to generate value for a wider set of stakeholders (Ferri et al., 2014). Among the key features of cooperative banks is that they are owned by their members, who are entitled to only one vote and their stakes are generally not marketable. Similar to cooperatives, savings banks tend to have a dual financial and social mission (i.e. 'double bottom line') to serve the community in which they are located (Ayadi et al., 2009). At the same time, savings banks differ from cooperatives in that they are owned either by a private foundation or by an organisation that belongs to the government, suggesting that they are not strictly profit-oriented institutions. Consistent with their property right structure and the related obstacles—especially for cooperative banks—in raising external capital (Ayadi et al., 2010), stakeholder banks tend to have lower incentives to engage in risk-taking activities to increase their equity returns than shareholder banks (Llewellyn, 2017). For these reasons, one would expect monetary policy to have greater effects on the risk appetite of shareholder banks compared to their stake-

holder counterparts. It follows that a key motivation behind this thesis is to test the extent to which the presence of stakeholder banks vis-à-vis shareholder banks has a bearing on the functioning of the risk-taking channel. As illustrated later in this manuscript, the decision to focus on this channel of monetary transmission is a response to the somewhat limited literature in the area in spite of the increasing acknowledgement by policymakers and other observers of the implications that monetary policy may have for financial stability. In more formal terms, the research question (RQ) that informs this study can be stated as follows:

RQ. How does ownership structure affect the relationship between monetary policy and bank risk?

Taking this overarching research question as the point of departure, this thesis intends to fill the gaps identified in Section 1.1 by focusing on three primary research objectives: (1) to systematically review the literature on the role of financial intermediaries as vehicles for monetary policy transmission; (2) to investigate how the risk appetite of shareholder banks vis-à-vis stakeholder banks responds to variations in monetary conditions; and (3) to evaluate how ownership diversity in banking influences the risk-taking channel of monetary transmission.

Broadly speaking, this thesis is positioned at the intersection of five major bodies of literature. First, it contributes to a rapidly evolving strand of research that is concerned with the implications of monetary policy for risk-taking activities carried out by financial intermediaries. Studies in this area offer some theoretical as well as empirical support for a risk-taking channel of monetary transmission that operates through changes in risk perception and tolerance by banks (Ioannidou et al., 2015; Jiménez et al., 2014; Maddaloni and Peydró, 2013). Second, this study draws its theoretical underpinnings from property rights (Alchian and Demsetz, 1972) and agency (Jensen and Meckling, 1976) theories. Taken together, these theories predict

that the ownership structure of banks has a bearing on their behaviour, performance and probability of survival (Fama and Jensen, 1983; O'Hara, 1981; Rasmusen, 1988). Third, my work extends a recent stream of literature that explores the contribution of diversity in banking to the stability of the financial system and its resilience to crises (Ayadi et al., 2010; Ferri et al., 2014; Groeneveld and Llewellyn, 2012). In a nutshell, this literature contends that a financial system characterised by a diversity of ownership structures, business models and corporate objectives is likely to be more stable than one dominated by a single model (Llewellyn, 2017). Fourth, this study joins the body of research that endeavours to uncover the implications of market structure for the monetary transmission mechanism (Olivero et al., 2011). Within the context of the risk-taking channel, this body of research shows that bank market power tends to buffer the impact of monetary policy on bank risk (Brissimis et al., 2014; Kick and Prieto, 2015). Fifth, this thesis borrows concepts from the field of ecology, where a community populated by individuals belonging to different species is generally seen as more stable than a monoculture (Jizhong et al., 1991). Building on the work by Michie and Oughton (2013), this study treats ownership types (i.e. commercial, cooperative and savings) as analogous to species in an ecosystem and computes indices of ownership diversity in the banking sector.

1.3 Summary of Contribution

In addressing the three research objectives identified above, this thesis makes an important contribution to knowledge.

First, it refines our understanding of the role of financial intermediaries in monetary policy transmission (Bernanke and Gertler, 1995; Kashyap and Stein, 2000; Kishan and Opiela, 2006). By conducting a systematic review of the literature (Counsell, 1997; Tranfield et al., 2003), this research classifies existing studies within a multidimensional framework that combines the mechanisms (i.e. the channels through which financial intermediaries act as conduits for monetary policy trans-

mission) and the underlying conditions (i.e. the factors impacting on the functioning of the corresponding mechanism) of the monetary transmission process via financial institutions. This framework may allow for a more inclusive view of how central bank interventions are mediated by financial intermediaries' behaviour, while presenting researchers with a tool for reviewing the extant literature in a systematic manner and for positioning their contributions within a broader context. To my knowledge, the proposed framework constitutes the first attempt to comprehensively organise the research on the role of financial institutions within the context of monetary policy transmission. For this reason, the framework developed in this study can be used as a springboard for future quantitative and qualitative research dealing with the monetary transmission mechanism via financial intermediaries.

Second, this thesis advances knowledge in the field by incorporating concepts from the property rights (Alchian and Demsetz, 1972) and agency theory (Jensen and Meckling, 1976) perspectives into the analysis of the risk-taking channel. By estimating the effects of monetary policy on the risk appetite of shareholder and stakeholder banks, this study extends the literature that investigates the extent to which monetary conditions prevailing in the economy shape risk-taking incentives by banks (Borio and Zhu, 2012; Ioannidou et al., 2015; Jiménez et al., 2014). In doing so, it also contributes to the body of knowledge around the implications of bank ownership for monetary policy transmission (Drakos et al., 2016; Ferri et al., 2014). Moreover, this thesis endeavours to redress the paucity of evidence on the role that stakeholder banks play within the monetary transmission mechanism in general and the risk-taking channel in particular. It follows that the findings of my research add to the growing literature on the systemic benefits to be derived from a critical mass of stakeholder banks operating alongside their shareholder counterparts (Casu and Gall, 2016; Llewellyn, 2012; Michie, 2011).

Third, this study draws on insights from ecology—where interconnections between parts of an ecosystem are viewed as key drivers of its stability and resilience

(Tilman and Downing, 1994)—and provides novel insights into how ownership diversity in banking influences financial stability (Groeneveld, 2012; Haldane and May, 2011; Llewellyn, 2017). To this end, this thesis builds on the work by Michie and Oughton (2013) and estimates the ownership composition of the banking system in terms of relative market shares of shareholder banks vis-à-vis stakeholder banks. By introducing measures commonly used in ecology to quantify diversity into the study of the risk-taking channel, my research contributes to the somewhat limited literature around the effects of industry-related factors on the functioning of the risk-taking channel (Brissimis et al., 2014; Kick and Prieto, 2015). This thesis also makes an important methodological contribution, in that it borrows from the field of ecology and derives indices of ownership diversity for 17 Western European countries over the 1999–2011 period. These indices could be employed by future studies exploring the implications of diversity in banking for a number of financial and economic phenomena, while contributing further to the development of measures through which ownership diversity can be quantified, monitored and reported (Michie and Oughton, 2013).

1.4 Thesis Structure

This thesis is organised in the 'paper format', that is, it is structured so as to deliver its intellectual contribution through a series of distinct chapters in the format of journal articles (as advised by the Cranfield University's guidelines for the format of PhD theses). Each chapter represents a self-contained description of all aspects related to the individual packages of work and includes a literature review, methodology, results and discussion addressing one of the three research objectives stated in Section 1.2. Taken together, the chapters describe a single programme of research and contribute towards the overall aim of the work. Among the major advantages associated with this style of thesis are the availability of a set of manuscripts for submission to peer-reviewed journals and the opportunity to gain experience in writ-

ing stand-alone, concise academic papers. The remainder of the thesis proceeds as follows.

Chapter 2 focuses on the first research objective that guides this study, namely to systematically review the literature on the role of financial intermediaries as vehicles for monetary policy transmission. The chapter starts off by explaining the methodology adopted in the paper and by detailing the key steps followed while planning and conducting the review. Thereafter, it offers a descriptive overview and a thematic analysis of the results. A synthesis of the review findings is then presented in the form of a multidimensional framework, which serves to define the wider context within which the whole thesis is located. The implications of the proposed framework for practitioners and policymakers are discussed, together with a research agenda for advancing knowledge in the field. The paper concludes by highlighting some opportunities for gradually repositioning this topic as a legitimate area of theoretical and empirical analysis in management and organisation studies.

Chapter 3 is linked to the second research objective of this thesis, that is, to investigate how the risk appetite of shareholder banks vis-à-vis stakeholder banks responds to variations in monetary conditions. In doing so, it fills some of the gaps in the literature identified in Chapter 2. The first part of the manuscript surveys the related literature and formulates a series of testable predictions. It proceeds by describing the process that was followed in building the sample and in computing the variables used in the analysis. Consequently, the chapter specifies the econometric model estimated and considers some of the empirical challenges that arise when investigating the monetary policy–bank risk taking nexus. The results from the main estimations as well as from a series of additional robustness tests are then reported. The last part of the paper discusses the significance of the findings in light of existing research and clarifies the contribution of my study. The policy implications of the findings, along with the main limitations characterising the paper and some directions for future research, are also examined.

Chapter 4 takes the findings reported in Chapter 3 as the point of departure and addresses the third research objective underpinning my work, i.e. to evaluate how ownership diversity in banking influences the risk-taking channel of monetary transmission. As a result, this chapter moves the analysis one step further and provides evidence on how the interactions between banks with different ownership structures affect the relationship between monetary policy and bank risk. The initial part of the paper includes an overview of the literature on the risk-taking channel and develops the main hypotheses. The chapter then illustrates how the sample was constructed and how the indices of ownership diversity, alongside the other variables used in the empirical estimations, were derived. The benchmark model and estimation method are also described. Subsequently, the results from the baseline estimations and from various robustness checks are presented. Specific attention is devoted to explaining how the findings contribute to knowledge and what implications they have for monetary authorities as well as banking regulators. The manuscript concludes with a list of fruitful research avenues that originate from this paper and which could advance knowledge in this field of enquiry.

Chapter 5 brings the findings from the different papers together and discusses the overall contribution of the thesis at the theoretical, methodological and empirical levels. A detailed description of the implications that my research has for practitioners and policymakers is also reported. In addition, the chapter summarises the efforts that I have made thus far to disseminate my findings and provides a list of my academic papers, awards and presentations throughout my registration period. The chapter concludes with a discussion of the main limitations of my thesis and with some suggestions on how my research could be taken forward.

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Chapter 2

Financial Firms as Vehicles for Monetary Policy Transmission: A Systematic Literature Review and Future Directions

Abstract

Research on the role of financial firms as conduits for monetary policy transmission has grown rapidly over the last few years. This notwithstanding, the scholarly debate has been confined almost exclusively to the disciplines of finance and economics, while individual contributions have remained scattered. Drawing on the Systematic Literature Review (SLR) methodology and a sample of 152 articles published over the 1963–2016 period, this paper organises the extant knowledge within a multidimensional framework that combines (1) the mechanisms through which monetary policy is transmitted to the real economy via financial intermediaries and (2) the conditions underpinning the functioning of these mechanisms. The review finds support for a multifaceted role of financial institutions as mediators between central bank interventions and economic outcomes. A key finding is that the response of financial firms to changes in monetary policy matters not only for economic performance, but also for the soundness of the financial system. The proposed framework allows scholars to review the existing literature in a systematic manner and locate their work into a wider context, while contributing towards a more holistic approach to the review topic. The implications of the framework for practitioners and policymakers are identified, alongside a concrete agenda for furthering our understanding

of this important field of research. Some opportunities for gradually repositioning this topic as a legitimate area of theoretical and empirical analysis in management studies are also highlighted.

Keywords: Bank risk taking; economic performance; financial crisis; financial sector; financial stability; monetary transmission mechanism.

2.1 Introduction

Recent years have witnessed a renewed interest in institutions and organisations, as demonstrated by the growth in institutional research and the use of the institution concept across a range of disciplines such as management, economics, sociology and geography. According to North (1991, p. 97), institutions provide the formal and informal 'rules of the game' that structure political, economic and social interaction. As a result, institutions are viewed as the type of structures that matter the most within society, since "they make up the stuff of social life" (Hodgson, 2006, p. 2). If institutions define the rules of the game, organisations and their entrepreneurs are seen as the players (North, 1994). Organisations are considered as the most important institution in modern society (Zucker, 1977), since they represent a significant source of variability as well as prominent actor (Greenwood et al., 2014). There is nowadays considerable agreement among scholars on the need to develop a greater understanding of not only the nature of institutions and organisations (Green and Li, 2011), but also their role in shaping economic outcomes (Acemoglu et al., 2001; Buchanan et al., 2014; Chang, 2011).

A vivid illustration of how institutions in general and organisations in particular may influence the course of the economy is offered by the 'great crash' of 2008 (Hodgson, 2009), arguably the most severe economic downturn since the Great Depression of the 1930s. Among the plethora of explanations behind the global financial crisis, a growing strand of the literature places the spotlight on monetary policy and the role it played in influencing organisational behaviour (Borio and Zhu, 2012; Dell'Ariccia et al., 2014). In the aftermath of the dot-com bust, a number of central banks throughout the world tackled fears of an economic slowdown by gradually decreasing nominal interest rates. By the mid-2000s, these policies resulted in nominal rates reaching historically low levels. In the US, money market rates dropped from 6.26% in 2000 to 3.22% in 2005, with a record low of 1.13% in 2003. Similarly, in the euro area money market rates fell from 4.12% in 2000 to 2.09% in 2005, while

in the UK they went down from 5.84% in 2000 to 4.68% in 2005. This environment of relatively low interest rates—the theory goes—triggered excessive risk taking by financial firms through underlying changes in risk perception and aversion, thereby contributing to the build-up of risks in the economy. In a nutshell, this line of argument elaborates that 'too-low-for-too-long' interest rates led to a reduction in information asymmetries and bank profits (Dell'Ariccia and Marquez, 2006). In an attempt to counterbalance the negative effects on their margins, financial intermediaries reacted by loosening lending standards, thus raising the level of risk in their portfolios and the associated probability of failure.[1]

Spurred by the recent economic meltdown, research on the mediating role of financial firms as vehicles for monetary policy transmission has grown rapidly over the last few years. These works have addressed a number of aspects associated with this complex phenomenon, such as the effects of asymmetric information in credit markets on the monetary transmission mechanism (e.g. Neyer, 2007),[2] the consequences of increased globalisation of banking for the propagation of international shocks (e.g. Cetorelli and Goldberg, 2011) and the implications of active balance sheet management by financial firms for monetary policy effectiveness (e.g. Adrian and Shin, 2010). Although some of these issues may go beyond the scope of management studies, a growing number of contributions have been concerned with a variety of aspects that are more micro-founded. Some examples include the lending supply reactions of shareholder- vis-à-vis stakeholder-oriented banks to variations in the monetary stance (Ferri et al., 2014), the different risk-taking behaviours of banks with varying degrees of capitalisation in response to monetary policy changes (Jiménez et al., 2014) and the importance of relationship lending for the price-setting

[1] In explaining why Citigroup continued financing loans despite soaring risks, its former Chairman Chuck Prince said: "[w]hen the music stops, in terms of liquidity, things will be complicated. But, as long as the music is playing, you've got to get up and dance. We're still dancing" (*Financial Times*, July 9, 2007).

[2] According to Taylor (1995), the monetary transmission mechanism describes the process through which monetary policy decisions affect real output and inflation.

behaviour of banks (Gambacorta, 2008). These aspects are indeed not outside the scope of managerial theory and practice, as they show how the transmission of monetary impulses to the real economy depends critically on the strategies and actions of financial firms (Kashyap and Stein, 2000; Kishan and Opiela, 2000). Yet, the diversity of topics examined by the literature has made it difficult for researchers to build on each other's work, resulting in a highly fragmented body of evidence and hindering progress in this important field of research.

Against this background, the aim of this paper is to develop an integrated view of the role of financial firms as vehicles for monetary policy transmission by conducting a systematic review of the extant literature. Drawing on the Systematic Literature Review (SLR) methodology (Counsell, 1997; Tranfield et al., 2003), this study evaluates existing contributions on the monetary transmission process via financial institutions in terms of what is known about (1) the mechanisms (i.e. what are the channels through which monetary policy is transmitted to the real economy via financial firms?) and (2) the conditions (i.e. what variables affect the ability of financial firms to act as conduits for monetary policy transmission and at what level do they operate?). In addressing these questions, this review makes a twofold contribution. On the one hand, it organises existing studies within a multidimensional framework that combines mechanisms and underlying conditions of the monetary transmission mechanism via financial firms, thereby allowing scholars to review the existing literature in a systematic manner and locate their research efforts into a wider context. On the other hand, this paper suggests complementary avenues for future research and highlights some opportunities for gradually repositioning this topic as a legitimate area of theoretical and empirical analysis in management studies. In light of the discussion that has ensued on whether the current environment of exceptionally low interest rates is already sowing the seeds for the next financial crisis, this review appears to be particularly timely.

The remainder of the article is structured as follows. Section 2.2 explains the

methodology used in this study and details the main steps followed while planning and conducting the review. Section 2.3 presents a descriptive overview and a thematic analysis of the results, along with a synthesis of the review findings in the form of a multidimensional framework. Section 2.4 discusses the results, advances suggestions for future research and describes the implications as well as limitations of this paper. Section 2.5 offers some reflections and concludes.

2.2 Methodology

Originally developed in the field of medical sciences during the early 1980s, the SLR approach has emerged as a rigorous means of finding, investigating and combining evidence about the effectiveness of alternative healthcare interventions (Counsell, 1997). Since then, the SLR has spread to a number of other disciplines as a useful tool for providing practitioners and policymakers with a reliable basis on which to make decisions (Tranfield et al., 2003). According to its proponents, the systematic approach to reviewing the literature helps minimise potential biases by means of a replicable, transparent and scientific review process (Denyer and Tranfield, 2009). The primary aim is to select, appraise and integrate all the existing studies that are relevant to the review being undertaken, regardless of their place of publication or disciplinary background (Thorpe et al., 2005). For this reason, the SLR is generally viewed as a "good scientific practice" (Rousseau et al., 2008, p. 479) and "an efficient technique for hypothesis testing" (Petticrew, 2001, p. 99), thereby being invoked as a robust alternative to traditional narrative reviews (Denyer and Neely, 2004).

2.2.1 Review Strategy

In line with the approach suggested by Tranfield et al. (2003), the review was conducted on the basis of three major stages: (1) development of a review plan; (2) selection, analysis and synthesis of relevant studies; and (3) reporting and dissemination of the review findings. Prior to embarking on the review, a panel was formed

consisting of four scholars with expertise in the area being examined and three (two academics and a librarian) systematic review specialists. The purpose of the panel was to provide guidance on the review process and resolve any dispute regarding the inclusion and exclusion of studies. Following the institution of a review panel, a scoping study was produced with the aim of assessing the relevance and size of the literature as well as delimiting the subject area (Tranfield et al., 2003).

On the basis of the scoping study, I set my objective as the systematic assessment of the theoretical, conceptual and empirical evidence on the micro-foundations of the monetary transmission mechanism via financial firms. Drawing on the CIMO (Context, Intervention, Mechanism and Outcome) logic put forward by Denyer and Tranfield (2009), the following overarching question to be addressed in the systematic review was formulated: what role do financial firms play in monetary policy transmission? Specifically, the review was driven by two closely intertwined sub-questions: (1) what are the mechanisms (M) through which monetary policy (I) is transmitted to the real economy via financial intermediaries (O)? and (2) under what conditions (C) are these mechanisms operative?

Consistent with the principles underpinning the SLR methodology (Tranfield et al., 2003), the above decisions were formalised into a review protocol. Besides including the aim and question as well as sub-questions underlying the review, this document contains detailed information pertaining to four additional areas: (1) the search strategy; (2) the inclusion and exclusion criteria; (3) the standards for quality appraisal; and (4) the plan for data extraction and synthesis. After framing the review question, the next step involved the identification of appropriate keywords and search terms. In an attempt to ensure that all the relevant references could be retrieved, keywords were selected on the basis of a careful examination of the literature included in the scoping study. This process yielded a final list of 19 keywords, 9 of which associated with the concept of 'monetary policy' (Category A)

and 10 related to the term 'financial intermediary' (Category B).[3] The terms from Category A were then combined with the keywords from Category B via the Boolean operator 'AND', resulting in a total of $9 \times 10 = 90$ search strings (e.g. 'monetary polic*' AND 'financial firm*', 'monetary transmission' AND 'financial intermedia*' and 'interest rate*' AND 'bank*').

Following the definition of the search strategy, specific efforts were made to develop valid criteria for the inclusion and exclusion of studies.[4] First, I limited the sources to peer-reviewed journals. As suggested by Podsakoff et al. (2005), academic journals are usually regarded as containing validated knowledge that is likely to have the highest impact in the field. Moreover, I followed an approach similar to Meier (2011) and considered only publications in scholarly journals with an Impact Factor greater than or equal to the Median Impact Factor for the relevant category (e.g. 'Business, Finance') in the 2016 Journal Citation Reports® by Clarivate Analytics.[5] While allowing to draw conclusions based on a group of authoritative contributions, this criterion served as a useful device for reducing the scope of the review which could otherwise be overwhelming. As to the more substantive criteria, I included theoretical, conceptual and empirical articles with a specific focus on the role played by financial firms in monetary policy transmission, along with some evidence of the micro-foundations of the monetary transmission mechanism via financial institutions. In addition, a broad definition of monetary policy was adopted as consisting of any operation through which the central bank pursues its mandate by targeting

[3]The keywords used in the review were the following: 'monetary polic*', 'monetary shock*', 'monetary expansion*', 'monetary impulse*', 'monetary contraction*', 'monetary tightening*', 'monetary transmission', 'interest rate*', 'policy rate*' (Category A) and 'bank*', 'financial intermedia*', 'financial institution*', 'financial firm*', 'financial system*', 'financial sector*', 'financial industr*', 'financial friction*', 'credit friction*', 'credit market*' (Category B). Furthermore, 35 additional keywords were excluded because not productive when run individually against another keyword.

[4]The full list of the inclusion and exclusion criteria with their underlying rationale is included in Appendix Table A.1.

[5]My approach differs from Meier (2011) in that I decided not to set a subjective threshold (i.e. a 5-Year Impact Factor higher than 1.5), but instead focused on the position of each journal relative to the overall distribution of journals within the relevant category.

either financial market prices (e.g. short-term interest rates) or financial market quantities (e.g. money supply). Similarly, I did not delimit the focus of the review with respect to the type of financial institutions and included studies dealing not only with banking firms, but also with other categories of financial institutions (e.g. broker-dealers, insurance companies and pension funds).

Finally, the review protocol contains two sections dedicated to the criteria for quality appraisal and the plan for data extraction and synthesis. On the one hand, I chose not to fix an a priori list of standards to be used for quality appraisal, but instead developed an ad hoc checklist by looking at the reviewer guidelines from the journals included in the analysis. On the other hand, I devised a data extraction form aimed at assisting with the analysis and synthesis of data. As a last component of the review plan, I developed a strategy for integrating findings across studies based on the methodology known as 'realist synthesis' (Pawson, 2002). In light of its emphasis on the causal mechanisms underlying different types of intervention (Mays et al., 2005), this approach is particularly well suited to addressing my review question.

2.2.2 Data Collection

After formulating the review strategy, the search strings developed in my protocol were used to investigate eight citation databases: ABI/INFORM Complete, EBSCO Business Source Complete, Emerald Insight, ScienceDirect, Scopus, Taylor & Francis Online and Web of Science.[6] This initial search yielded a total of 24,332 hits, with an average of 3,476 references per database. The citation data and abstract of each study were exported to RefWorks, where references were organised in alphabetical order per primary author and duplicates removed. At the end of this process, I was left with 12,133 citations to be examined on title and abstract. These references

[6]Since Taylor & Francis Online did not allow a search on the basis of truncated terms, for this database all the possible variant word endings were considered and a final list of 39 keywords (17 for Category A and 22 for Category B) was used.

were reviewed according to the inclusion and exclusion criteria, resulting in 11,835 citations being rejected because not meeting the set criteria.[7]

The remaining group of 298 articles was considered for full-text analysis. After screening the text of each study on the basis of the inclusion and exclusion criteria, I was able to separate references into A (highly relevant), B (moderately relevant) and C (non-relevant) lists.[8] To account for the possible rigidity of the search strategy, the A-list of 139 articles was used to perform a series of additional checks. First, with the aim of triangulating the results of the main search, I systematically investigated the websites of the 12 journals in the sample with a number of references greater than the average.[9] Furthermore, I ranked the studies according to the number of times they had been cited in Web of Science and tracked the citations of those articles with above mean annual values.[10] Third, the reference section of all the included studies was examined carefully to check for relevant articles that were not retrieved through the keyword search.[11] This procedure resulted in 21 more articles being added to the sample.

The 160 references that were left following the aforementioned stages were finally

[7]The majority of the studies were eliminated because, although being peer-reviewed journal articles, they were either not focused on the role played by financial firms in the monetary transmission mechanism or they were published in journals with an Impact Factor below the identified threshold.

[8]The B list contains articles that, even though not providing evidence on the micro-foundations of the monetary transmission mechanism through financial firms, were somewhat relevant to the topic under review (e.g. focus on the macroeconomic implications of financial frictions, link between financial intermediaries and business cycle fluctuations or the optimal conduct of monetary policy in the presence of financial frictions). Conversely, the C-list studies were excluded because not meeting the assessment criteria (e.g. not a full-text journal article, focus on non-financial firms or emphasis on the wider role played by financial intermediaries in the economy).

[9]The journals selected were the following: *Journal of Banking and Finance*; *Journal of Money, Credit, and Banking*; *Journal of International Money and Finance*; *American Economic Review*; *Journal of Policy Modeling*; *European Economic Review*; *International Journal of Central Banking*; *Journal of International Financial Markets, Institutions and Money*; *Journal of Finance*; *Journal of Monetary Economics*; *German Economic Review*; *Journal of Economic Dynamics and Control*.

[10]When data on the citation count were not available in Web of Science, the relevant information was retrieved from Scopus, EBSCO Business Source Complete or Google Scholar.

[11]The checks led to the inclusion of 12 studies that, although being published in sources with an Impact Factor below the specified threshold, appear to have influenced significantly the relevant debates in the subject area.

evaluated against a set of predetermined criteria. Drawing on the guidelines for reviewers available at the websites of the journals considered in the review, a 15-point checklist aimed at helping determine the overall quality of each article was created.[12] After assessing all the studies according to the quality criteria, I decided to exclude eight citations that seemed to raise some concerns with respect to one or more of the five areas making up the quality appraisal tool.[13] Therefore, the selection process led to the identification of 152 studies as being highly relevant to the review question and fulfilling the quality requirements. This list of articles was then imported into NVivo for data extraction purposes and constitutes the basis on which the claims in this paper are made. Figure 2.1 summarises the selection process followed in the review.

2.3 Results

2.3.1 Descriptive Analysis

Table 2.1 reports the distribution of the 152 articles included in the final sample according to their source title. At a glance, the *Journal of Banking and Finance* and the *Journal of Money, Credit and Banking* appear to be the major outlets for the dissemination of scholarly research on the topic, accounting for 14% and 9%, respectively, of the overall number of studies selected for the review. At a closer look, the academic debate in the subject area seems to be located primarily between the fields of finance and monetary economics, while the majority of the contributions come from either US- or European-based journals. At the same time, academic research concerned with the role played by financial intermediaries as

[12] The full list of questions included in the checklist is reported in Appendix Table A.2.

[13] While five references were rejected because of a somewhat serious neglect of key contributions in the field when building the relevant theoretical framework, three articles were not included due to substantial concerns over the existence of sufficient information to support the recommendations being put forward.

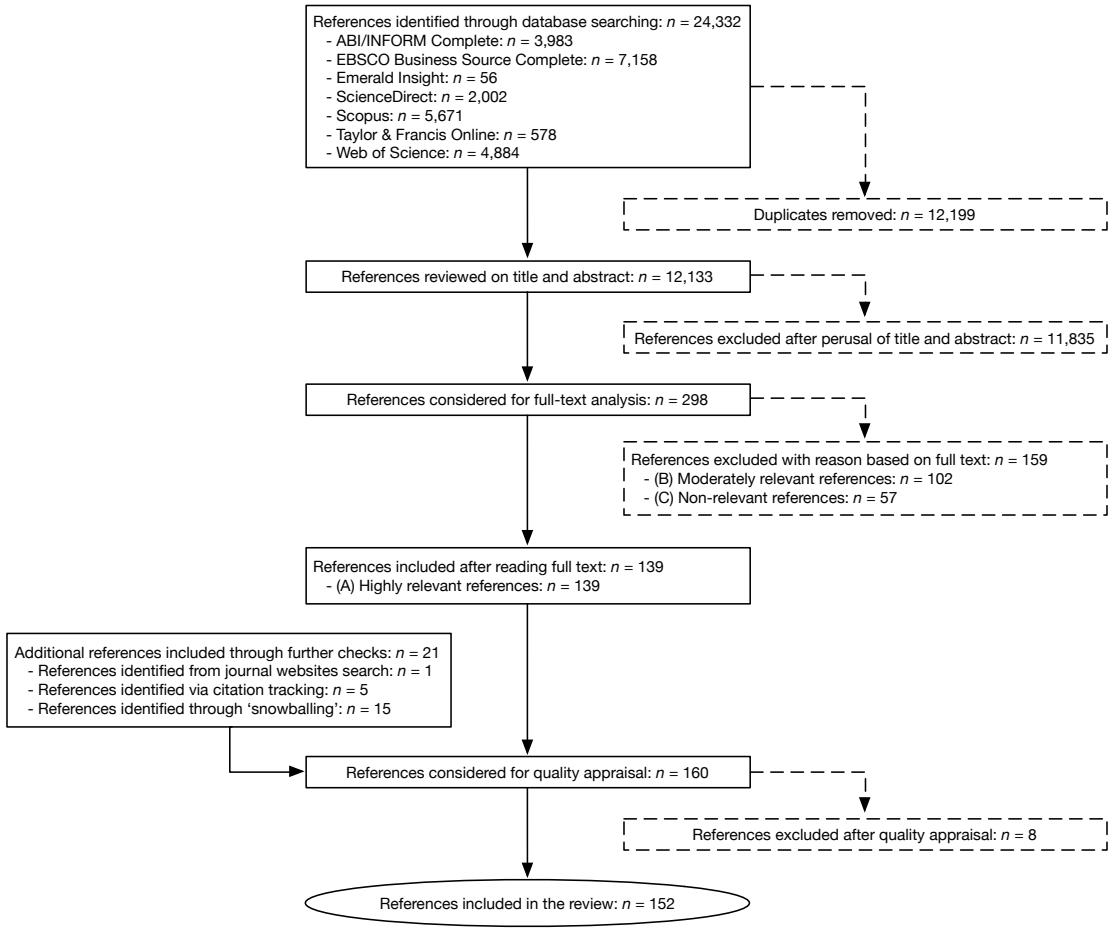

Figure 2.1 Summary Diagram of the Selection Process

Notes: The figure illustrates the steps that were followed in selecting the review sample. Continuous lines denote stages in which references were included, whereas dotted lines represent steps where references were excluded.

vehicles for monetary policy transmission has observed a significant increase over the last decade. Figure 2.2 shows the number of articles by year of publication from 1963 (the year of the oldest study in the sample) to 2016 (the year of the most recent contributions included in the review). Whereas the annual number of studies has been somewhat constant until the late 1990s, there is evidence of a spike around the mid-2000s and a fairly important increase during the most recent years. The cumulative number of publications grew from 46 in 2005 to 152 in 2016, representing an increase of approximately 230%. Broadly speaking, this somewhat crude data

appears to reflect a revived interest in the topic, in line with the ongoing debate over the interplay between financial firms' behaviour and monetary authorities' decisions.

Table 2.1 Distribution of Articles by Source Title

Source title	No. of articles	% of sample
Journal of Banking and Finance	22	14%
Journal of Money, Credit, and Banking	13	9%
Journal of International Money and Finance	9	6%
Journal of International Financial Markets, Institutions and Money	8	5%
American Economic Review; *Journal of Policy Modeling*	7	5%
European Economic Review; *International Journal of Central Banking*; *Journal of Finance*	6	4%
International Review of Economics and Finance; *Journal of Monetary Economics*	5	3%
Journal of Economic Dynamics and Control; *Journal of Financial Stability*	4	3%
Econometrica; *Economic Inquiry*; *Economic Policy*; *Economica*; *European Financial Management*; *IMF Economic Review* (formerly *IMF Staff Papers*); *International Review of Financial Analysis*; *Journal of Applied Econometrics*; *Journal of Financial Services Research*; *Journal of the European Economic Association*; *Journal of the Japanese and International Economies*; *Quarterly Journal of Economics*; *Review of Financial Studies*	2	1%
AEA Papers and Proceedings; *Brookings Papers on Economic Activity*; *Cambridge University Press*; *China Economic Review*; *De Nederlandsche Bank Research Memoranda WO&E*; *ECB Working Paper Series*; *Emerging Markets Review*; *Federal Reserve Bank of Boston Conference Series*; *Federal Reserve Bank of New York Economic Policy Review*; *Federal Reserve Bank of New York Staff Reports*; *German Economic Review*; *IMF Working Papers*; *Journal of Comparative Economics*; *Journal of Economic Perspectives*; *Journal of Economic Theory*; *Journal of Economics and Business*; *Journal of Financial Economics*; *Journal of Financial Intermediation*; *NBER Working Paper Series*; *RAND Journal of Economics*; *Regional Studies*; *Review of Economic Dynamics*; *Review of Finance*; *Scandinavian Journal of Economics*	1	1%

Notes: The table shows the distribution of articles by source title. The number of articles and the percentage of sample are calculated on a per title basis. The sample period goes from 1963 to 2016.

In terms of the composition of the sample, Figure 2.3 presents a breakdown of

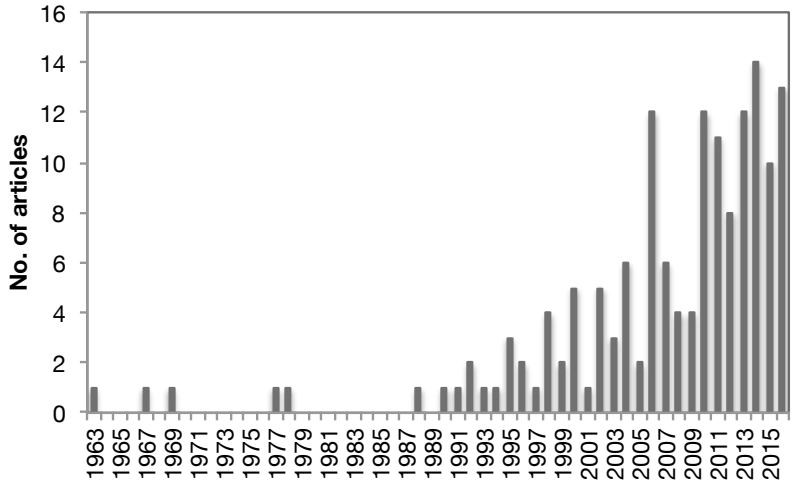

Figure 2.2 Number of Articles per Year of Publication

Notes: The figure depicts the number of articles by year of publication. The sample period goes from 1963 to 2016.

the articles by paper type, whereas Figure 2.4 illustrates the distribution of empirical studies according to their geographical focus. The most common type of papers is constituted by empirical articles (84%), with a greater emphasis on theory testing (65%) than on theory building (19%). The number of theoretical studies is rather limited (13%), whilst conceptual articles represent the smallest share (3%). Among the empirical papers, 39% of the articles offer evidence drawn from the European context, while about one third of the studies place their emphasis on the US. Particularly interesting is the somewhat limited number of contributions dealing with mixed evidence from industrial (10%) or developing (4%) countries. A few articles offer empirical findings related to Asian (9%) or other (4%) geographical areas. Taken together, this data seems to show—perhaps not surprisingly—that the scholarly dialogue on the role of financial institutions in monetary policy transmission is located primarily in Europe and the US.

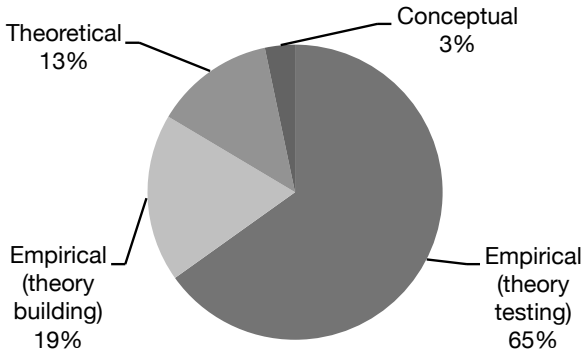

Figure 2.3 Breakdown of Articles by Paper Type

Notes: The figure reports the distribution of articles by paper type. The sample period goes from 1963 to 2016.

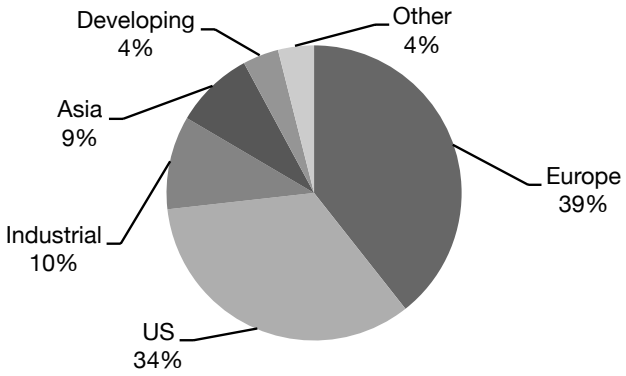

Figure 2.4 Breakdown of Empirical Articles by Geographical Focus

Notes: The figure presents the distribution of empirical articles by geographical focus. The sample period goes from 1963 to 2016.

2.3.2 Thematic Analysis

Consistent with the adoption of a realist synthesis approach (Pawson, 2002), all of the 152 articles were coded by drawing particular attention to two key themes: (1) the mechanisms through which monetary policy is transmitted to the economy via financial firms; and (2) the conditions under which these mechanisms are operative. After extracting the relevant data and identifying the emergent themes as well as

sub-themes, the studies were grouped according to their overarching themes. The full list of themes was then examined to search for higher order concepts, resulting in a final set of six superordinate themes: (1) 'interest rate pass-through'; (2) 'credit channel'; (3) 'bank lending channel'; (4) 'balance sheet channel'; (5) 'bank capital channel'; and (6) 'risk-taking channel'. Although some of these areas are not discrete and partially overlap, each of the identified themes corresponds to a different mechanism of monetary policy transmission in which financial firms are deemed to play a central role. The bank lending channel ($n = 55$) and the interest rate pass-through ($n = 37$) are the two most recurrent themes among the selected papers. By contrast, fewer articles focus on either the risk-taking channel ($n = 25$) or the credit channel ($n = 19$), whilst the smallest portion is represented by contributions dealing with the bank capital channel ($n = 10$) and the balance sheet channel ($n = 3$). In addition, only a handful of papers ($n = 3$) examine more than one channel simultaneously. With the aim of understanding "what works for whom in what circumstances" (Pawson, 2002, p. 342), the studies within each of the six domains listed above were finally grouped by looking at the specific conditions under which the corresponding mechanism is likely to be operative.

2.3.2.1 Interest Rate Pass-Through

As the textbook IS–LM model postulates, monetary policy affects the real economy through the impact of interest rates on aggregate demand. According to the money view of the monetary transmission mechanism, it is therefore paramount that financial intermediaries pass on changes in market rates to lending and deposit rates. Notwithstanding the critical role played by financial firms within the so-called 'interest rate channel', it is only recently that researchers have started to place specific emphasis on the pass-through of policy rates to bank retail rates. While pointing to the lack of a theoretical framework capable of informing empirical research, Kopecky and VanHoose (2012) develop a dynamic model of bank adjustment costs and show

that each determinant of retail rates is directly linked to the competitive structure of the market. Furthermore, in an attempt to provide a theoretical foundation for the interplay between bank pricing rules and monetary policy, Agénor and El Aynaoui (2010) demonstrate that excess liquidity may induce greater stickiness to deposit rates following a monetary tightening and translate into lower lending rates.

Turning to the empirical literature, a substantial body of evidence has investigated the extent to which the structure of the financial system influences the interest rate pass-through. In what is widely viewed as the seminal contribution in the area, Cottarelli and Kourelis (1994) point to the existence of a market for negotiable short-term instruments and the absence of constraints on banking competition as two of the main structural features enhancing lending rate flexibility. Building on Cottarelli and Kourelis (1994), Mojon (2000) focuses on the euro area and shows that market deregulation in general and competition in particular are two important factors underpinning the pass-through to credit and deposit rates.

A second question addressed by scholars concerns the implications of market concentration and—consequently—banking competition for bank pricing behaviour. The studies in this area suggest that banks operating in more concentrated markets exhibit greater price rigidity (Hannan and Berger, 1991; Neumark and Sharpe, 1992) and benefit from wider margins for loans and deposits compared to banks in more competitive industries (Corvoisier and Gropp, 2002; De Graeve et al., 2007). In addition, there is evidence that the degree of price rigidity is higher for banks of smaller size (Hannan and Berger, 1991) and with a larger capital buffer (De Graeve et al., 2007). In a similar vein, banking competition affects the pass-through to both loan rates (Brämer et al., 2013) and the volume of bank lending (Adams and Amel, 2011), whilst the speed of the adjustment process for deposit rates varies depending on whether the stimulus for a change is upwards or downwards (Hannan and Berger, 1991; Neumark and Sharpe, 1992).

Following the pioneering contribution by Cottarelli and Kourelis (1994), a grow-

ing strand of the literature has tested empirically for the validity of the 'completeness' and 'symmetry' hypotheses. Despite the somewhat heterogeneous nature characterising this body of work, it is worth highlighting three primary conclusions reached by these studies: (1) in the short run, the adjustment of retail rates to money market rates is incomplete (Burgstaller and Scharler, 2010; Gambacorta, 2008; Sander and Kleimeier, 2004);[14] (2) the degree of pass-through differs across financial institutions (Chong et al., 2006; Heffernan, 1997) and products (Belke et al., 2013; de Bondt, 2005; Chong et al., 2006; Égert et al., 2007; Heffernan, 1997; Kwapil and Scharler, 2010); and (3) the speed of the adjustment process depends on the sign of the policy rate change (Fuertes et al., 2010)[15] and on whether retail rates are above or below their equilibrium levels (Chong et al., 2006; Scholnick, 1996). Besides explanations related to the structure of the financial system, contributions in this area identify bank capital (Fuertes et al., 2010; Gambacorta, 2008), relationship lending (Gambacorta, 2008; Kitamura et al., 2016), product diversification (Fuertes et al., 2010) and geographical location (Montagnoli et al., 2016) as some of the bank-level variables influencing the interest rate pass-through.

Taken together, the aforementioned bodies of empirical literature share an important shortcoming, namely the neglect of interest rate expectations by financial firms. This seems problematic, since not accounting for the role of expected market rates when estimating models of interest rate pass-through may lead to erroneous conclusions. Consonant with this observation, scholars have recently started to investigate how anticipated and unanticipated changes in the monetary policy stance affect retail rates. This literature submits that market rate expectations play a significant part in determining not only bank retail rates (Banerjee et al., 2013; Kwapil and Scharler, 2013), but also the speed of the pass-through in loan markets (Kleimeier and Sander, 2006). A transparent and well-communicated monetary pol-

[14] Evidence of an incomplete pass-through in relation to some financial products even in the longer term is offered by Hofmann and Mizen (2004), Chionis and Leon (2006) and Rocha (2012).

[15] A different result is provided by Scholnick (1999).

icy is thus seen as a key requirement for a faster and more homogeneous pass-through (Kleimeier and Sander, 2006; Liu et al., 2008; Perera and Wickramanayake, 2016).

One spectacular feature of the global financial crisis was the apparent breakdown in the link between policy and money market rates in many jurisdictions. As a result, a new line of research has placed at the centre of its agenda the study of the interest rate pass-through during periods of financial distress. According to Karagiannis et al. (2010), disturbances in the functioning of the money markets in Europe and the US were reflected in a widening of retail rate spreads, thereby prompting additional measures by central banks in order to restore the effectiveness of monetary policy. Moving on from these premises, Hristov et al. (2014) show that the pass-through in the euro area has been significantly altered after the outbreak of the crisis, primarily as a result of changes in the structural parameters of the economies and a large increase in the average size of structural shocks. Similar findings are presented by Aristei and Gallo (2014), who point to an opportunistic behaviour by financial firms and a lack of confidence on their stability within the money markets as the major factors explaining the lower degree of pass-through. More recently, evidence has also been found in support of the key role played by government bond spreads for the pass-through in countries that were hit by the eurozone sovereign debt crisis (Cifarelli and Paladino, 2016), while non-standard monetary policy appears to have complemented standard monetary interventions in reducing bank lending rates (von Borstel et al., 2016).

2.3.2.2 Credit Channel

Another strand of the literature has moved analysis away from the traditional interest rate mechanism to examine the implications of frictions in credit markets for the propagation of monetary impulses. According to the credit view, the conventional interest rate effects are amplified by virtue of a 'credit channel' of monetary transmission (Bernanke and Gertler, 1995). In a nutshell, researchers in this area

contend that monetary policy affects the external finance premium in credit markets via its impact on the supply of loans by depository institutions ('bank lending channel') and on borrowers' balance sheets ('balance sheet channel'). In one of the first attempts to provide a theoretical foundation for the role of bank portfolios and—hence—bank credit in monetary transmission, Silber (1969) shows that a monetary policy-induced expansion in loans may be larger and generate more immediate effects than an expansion via bank purchases of securities (e.g. government bonds) from the public. Adopting a similar perspective, Labadie (1995) suggests that the influence of inflation on real returns to lending is important for explaining the propagation of monetary impulses via bank credit, while Repullo and Suarez (2000) argue that the behaviour of market lending becomes ambiguous if one includes some elements of the bank lending channel.

Following early evidence on the link between bank portfolio adjustments and monetary policy transmission (Barth et al., 1977; Bryan and Carleton, 1967; Campbell, 1978; Shearer, 1963), Bernanke and Blinder (1988, 1992) present the first empirical study supporting the existence of a credit channel of monetary transmission. By developing a variant of the IS–LM model that allows roles for both money and credit, Bernanke and Blinder (1988, 1992) find that monetary policy affects—at least in part—real activity by altering the composition of bank assets. Building on this line of research, scholars have begun to test for the existence of a credit channel. Notwithstanding the variety of empirical strategies employed to identify loan supply shocks, this body of evidence shows that monetary policy does influence bank loans (Ciccarelli et al., 2015; Hülsewig et al., 2006; Kashyap et al., 1993; Morgan, 1998; Peek et al., 2003). Nonetheless, in a famous critique to this strand of the literature, Romer and Romer (1990) offer evidence in support of the traditional money view of the transmission mechanism and argue that monetary policy is likely to operate mostly through bank liabilities (i.e. transactions balances) rather than bank assets (i.e. bank lending). Furthermore, recent findings suggest that the monetary expan-

sion pursued by the Federal Reserve over the past 15 years has neutralised the credit channel of monetary transmission (Orlowski, 2015).

In an attempt to provide a better picture of the transmission mechanism via the credit channel, few researchers have used disaggregated data to evaluate the relative importance of the two sub-channels within the credit view. Drawing on European data, de Bondt (1998) presents evidence consistent with the existence of both a bank lending channel and a balance sheet channel of monetary transmission, with the impact of monetary policy being stronger for relatively illiquid and small banks (bank lending channel) and as loan demand interacts with bank size (balance sheet channel). Contradictory results are nevertheless put forth by Aysun and Hepp (2013), who consider loan-level data for the US and show that the credit channel operates mostly through fluctuations in the sensitivity of bank lending to borrowers' balance sheets.

2.3.2.3 Bank Lending Channel

A growing body of literature has drawn attention to the bank lending channel of monetary policy transmission. Following Bernanke and Blinder (1988, 1992), scholars have made specific efforts to offer further theoretical support for the lending channel. While Stein (1998) shows that a drain in reserves indeed causes a cutback in loan supply, Aliaga-Díaz and Olivero (2010) demonstrate that an augmented version of the bank lending channel that accounts for firm heterogeneity should not be rejected in favour of alternative mechanisms. In contrast to this line of research, Diamond and Rajan (2006) cast doubts on the conceptual underpinnings of the traditional view à la Bernanke and Blinder (1988, 1992), suggesting a 'financial liquidity channel' of monetary transmission operating via the impact of monetary policy on real liquidity. In a similar vein, Disyatat (2011) claims that the emphasis on the central bank's ability to drain deposits is misplaced and presents an alternative formulation of the lending channel that operates mainly via the effects of

monetary policy on banks' balance sheet strength and risk perception.[16] Moreover, it has been established that banks' capacity to raise additional volume of deposits after a monetary restriction is dependent upon bank ownership (Andries and Billon, 2010).

A considerable number of studies have been concerned with testing empirically for the existence of a bank lending channel. Early findings from the US show that banks with less liquid balance sheets (Kashyap and Stein, 2000), smaller size (Kashyap and Stein, 2000; Kishan and Opiela, 2000) and a lower degree of capitalisation (Kishan and Opiela, 2000) are more responsive to changes in the monetary policy stance, consistent with the lending view of monetary transmission.[17] However, there is evidence that monetary impulses propagated via the bank lending channel may be limited (Jayaratne and Morgan, 2000) and not linked to the real economy (Ashcraft, 2006; Driscoll, 2004; Perez, 1998), while bank loan portfolios are found to behave in a somewhat unpredicted manner following a monetary tightening (den Haan et al., 2007). Contrary to the assumptions underpinning the lending view, support has also been found for an alternative model in which banks adjust traded assets and liabilities to take advantage of profit opportunities arising in loan markets (Fama, 2013).

Perhaps even less conclusive is the evidence from Europe, where the prominent role played by banks in ensuring an effective functioning of the financial system has stimulated extensive research in the area. Focusing primarily on the first link within the bank lending channel (i.e. the relationship between monetary policy and bank loan supply), much of this literature has attempted to uncover the distributional effects of monetary actions across banks. A number of studies document significant cross-sectional differences in the way banks with varying size (Akinci et al., 2013;

[16]The reformulated bank lending channel à la Disyatat (2011) finds empirical support in Halvorsen and Jacobsen (2016).

[17]More recent evidence in favour of a bank lending channel in the US is offered by Dave et al. (2013).

Matousek and Sarantis, 2009), liquidity (Chatelain et al., 2003; Ehrmann et al., 2003; Gambacorta, 2005; Jiménez et al., 2012; Matousek and Sarantis, 2009) and capitalisation (Akinci et al., 2013; Altunbas et al., 2002; Gambacorta, 2005; Jiménez et al., 2012) react to monetary actions. This notwithstanding, a concurrent strand of research submits that differences in banks' responses to monetary policy changes are not important enough for the bank lending channel to be a quantitatively significant mechanism (Favero et al., 1999; Frühwirth-Schnatter and Kaufmann, 2006). Furthermore, the relative strength and ultimate existence of a lending channel are shown to depend upon bank type (Kakes and Sturm, 2002; Küppers, 2001), market structure (De Santis and Surico, 2013) and de jure deposit guarantees (Opiela, 2008).

Despite the growing attention on the bank lending channel, little is the empirical evidence drawn from either non-US or non-European contexts. This is surprising, as such evidence could offer beneficial insights into the economic importance of this mechanism. One of the few contributions is advanced by Brissimis and Delis (2009), who consider a sample of six OECD countries and find that a bank lending channel is operative only in Japan and Greece. Similarly, Hosono (2006) shows that the impact of monetary policy on bank lending is stronger for smaller, less liquid and better capitalised banks, thereby suggesting that a lending channel is at work in Japan. Additional support in favour of the significant effects of monetary impulses on bank loan supply is put forward by Sun et al. (2010), who establish the existence of long-run relationships between monetary policy, bank balance sheet variables (i.e. deposits, loans and securities) and real activity within the Chinese context. More recently, Ramos-Tallada (2015) has examined the determinants of the bank lending channel in Brazil and found that various types of market uncertainty (e.g. interest rate volatility) have a bearing on the functioning of this channel.

Motivated by recent developments in financial markets, some studies have addressed the question of whether asset securitisation affects the bank lending channel.

According to Loutskina and Strahan (2009), securitisation is moving the banking model away from the traditional 'originate-and-hold' approach to one of 'originate-to-distribute', thus possibly mitigating banks' financial constraints along with their willingness to extend credit. Consonant with this proposition, greater securitisation activity is shown to alter the bank lending channel, by virtue of its impact on banks' ability to insulate loan supply from changes in monetary policy (Altunbas et al., 2009; Loutskina, 2011). Interestingly, this result appears to hold even if the entire Off-Balance-Sheet (OBS) portfolio of banks is considered rather than only securitised assets (Perera et al., 2014).

An area that has been investigated more recently by the lending channel literature pertains to the implications of banking competition for the functioning of this mechanism. Although this strand of research indicates that the competitive conditions characterising the banking industry impact on the effectiveness of monetary policy, there seems to be disagreement about the sign of this relationship. Whereas evidence from Asia and Latin America suggests that increased competition in banking impairs the transmission of monetary impulses via the bank lending channel (Olivero et al., 2011a; Yang and Shao, 2016), the opposite holds true in relation to the euro area (Fungácová et al., 2014; Leroy, 2014).[18] An explanation for these conflicting results is advanced by Khan et al. (2016), who collect bank-level data for five South-East Asian countries and show that the effects of competition on the bank lending channel depend crucially on the competition measure being used. Moreover, it is found that the strength of the lending channel is affected negatively by the degree of consolidation in the banking sector, with these effects being more pronounced among banks of smaller size (Olivero et al., 2011b).

Besides securitisation activity and banking competition, the literature on the lending channel has pointed to a number of other factors influencing the effectiveness

[18]Similar evidence is put forward by Brissimis et al. (2014), who focus on a sample of US and euro-area banks and find that market power buffers the impact of monetary policy on bank lending and risk taking.

of this channel. This body of evidence shows that the strength of the lending channel varies depending on variables such as bank ownership (Bhaumik et al., 2011; Ferri et al., 2014), bank business models (Gambacorta and Marqués-Ibánez, 2011), banks' financing costs (Breitenlechner et al., 2016), internal capital markets (Campello, 2002; Cetorelli and Goldberg, 2012), interest rate derivatives (Purnanandam, 2007), bank risk (Altunbas et al., 2010), involuntary excess reserves (Nguyen and Boateng, 2013), bank networks (Ehrmann and Worms, 2004), foreign bank penetration (Wu et al., 2011), sovereign risk (Cantero-Saiz et al., 2014), deposit rate ceilings (Koch, 2015) and central bank's liquidity injections (Salachas et al., 2016).

2.3.2.4 Balance Sheet Channel

While scholars have dedicated increasing attention to the bank lending channel, fewer attempts have been made to explore the effects of monetary policy on the demand for loans. According to Bernanke and Gertler (1995), fluctuations in the quality of borrowers' financial positions induced by changes in the monetary policy stance may affect their investment and spending decisions, thereby potentially altering their demand for bank sources of funding. A handful of US-based studies have tested for the existence of a balance sheet channel, along with the variables that may impact on the strength of this channel. By looking at internal capital markets in financial conglomerates, Ashcraft and Campello (2007) identify a demand-driven transmission mechanism that works via borrowers' creditworthiness and is independent from the bank lending channel. Similarly, Aysun and Hepp (2011) provide evidence consistent with a credit channel operating through borrowers' balance sheets and being stronger for banks that securitise some of their assets. Additional support in favour of a balance sheet channel is put forth by Alpanda and Aysun (2012), who suggest that its effectiveness has increased over time as a result of the growth in global banking. A recent attempt to uncover this mechanism of monetary transmission outside of the US is offered by Popov (2016), who focuses on eight Central

and Eastern European (CEE) countries and shows that easier monetary conditions lower the number of credit-constrained firms in the economy.

2.3.2.5 Bank Capital Channel

A fifth major strand of research has placed its emphasis on the role played by bank capital and macroprudential regulation in the propagation of monetary impulses to bank lending. From a theoretical perspective, Van den Heuvel (2002) argues that the standard interest rate mechanism is enhanced by way of a 'bank capital channel' of monetary transmission. Based on the existence of market imperfections that modify the standard results of the Modigliani–Miller (Modigliani and Miller, 1958) theorem (Gambacorta and Mistrulli, 2004), this thesis postulates that monetary shocks under risk-based capital requirements and an imperfect market for bank equity are likely to influence the supply of loans through their impact on the capital accumulation process. In line with the bank capital channel hypothesis, Kopecky and VanHoose (2004) demonstrate that binding capital requirements alter the responsiveness of bank loans to changes in reserves and are therefore not innocuous for monetary policy. Likewise, Chami and Cosimano (2010) show that monetary policy changes affect banks' ability to provide credit through variations in the option value of holding capital, while Bolton and Freixas (2006) find support for a credit-crunch equilibrium in the presence of high endogenous cost of capital. Furthermore, Baglioni (2007) develops a heterogeneous agents model with a capital requirement and demonstrates that well-capitalised banks act as important conduits for monetary policy transmission irrespective of the market structure.

The empirical literature has endeavoured to uncover the implications of capital requirements for the transmission of monetary policy. Early evidence on the relationship between capital regulation and loan supply is advanced by Peek and Rosengren (1995), who find that a lending channel disappears in the presence of binding capital constraints on banks. Similarly, Gambacorta and Mistrulli (2004) provide support

for a capital channel working primarily through small banks with a larger maturity mismatch in their balance sheets, while Kishan and Opiela (2006) suggest that less capitalised banks are adversely affected by a tightening and not an expansionary monetary policy only in the post–Basel/FDICIA period. Moreover, Cecchetti and Li (2008) focus on the interplay between monetary policy and capital regulation and establish that the central bank's attempt to ensure a sufficient supply of loans may be negatively influenced by the introduction of capital requirements. A somewhat less decisive result is reached by Thakor (1996), who shows that—under risk-based capital requirements—the effects of monetary policy on bank lending depend on its impact on the term structure of interest rates.

2.3.2.6 Risk-Taking Channel

Fuelled by the recent economic downturn, a growing number of studies have pointed to an additional channel of monetary transmission operating through the risk appetite of financial firms. According to Borio and Zhu (2012), changes in official rates affect either risk perceptions or tolerance via a 'risk-taking channel' of monetary policy transmission.[19] Broadly speaking, this channel works via three main mechanisms: (1) the impact of interest rates on valuations, incomes and cash flows (Borio and Zhu, 2012); (2) the existence of 'sticky' target rates of return (Rajan, 2006); and (3) the reaction function and communication policies of the central bank (Cao and Illing, 2015; Farhi and Tirole, 2012).[20] Among these mechanisms, particular attention has been devoted to the link between interest rates and the search-for-yield effect (Rajan, 2006). The central tenet of this theory is that a prolonged period of low interest rates may induce banks to soften their lending standards, thereby generating an equilibrium with deteriorated bank portfolios, lower and more volatile

[19] An alternative explanation is offered by Kishan and Opiela (2012), who identify a 'risk-pricing channel' of monetary transmission operating via the risk pricing of uninsured bank debt in the market for jumbo certificates of deposit.

[20] The relationship between the monetary policy reaction function and financial firms' risk exposure is also examined by de Groot (2014).

profits and higher aggregate credit (Dell'Ariccia and Marquez, 2006). Specifically, the existence of a link between interest rates and bank risk taking is shown to depend upon the bank capital structure (Dell'Ariccia et al., 2014), the size of the monetary shock (Valencia, 2014) and collateralised interbank borrowing (Cociuba et al., 2016).

Drawing on the theoretical framework above, the literature has recently started to investigate empirically the relationship between monetary policy and banks' appetite for risk. In what is generally seen as one of the pioneering contributions in the area, Jiménez et al. (2014) use a micro-level dataset for Spain and find support for a risk-taking channel operating through less-capitalised banks. In a similar vein, Ioannidou et al. (2015) focus on the Bolivian credit market and show that an expansionary monetary policy indeed increases banks' appetite for risk. Besides these seminal studies, evidence in favour of a risk-taking channel is found for both the US (Adrian and Shin, 2010; Angeloni et al., 2015; Bruno and Shin, 2015; Buch et al., 2014; Dell'Ariccia et al., 2013) and Europe (Delis and Kouretas, 2011; Maddaloni and Peydró, 2013). In addition, these results appear to hold even if somewhat more heterogeneous samples are considered (Adrian et al., 2010; Altunbas et al., 2014; Maddaloni and Peydró, 2011).

Despite the evidence of a statistically and economically significant relationship between monetary policy and risk-taking incentives at financial institutions, scholars seem to be divided on the determinants of this relationship. The empirical literature suggests that the effects of interest rates on banks' risk exposure differ according to bank capital (Delis and Kouretas, 2011; Dell'Ariccia et al., 2013; Jiménez et al., 2014), bank liquidity (Ioannidou et al., 2015), bank type (Buch et al., 2014), foreign funds (Ioannidou et al., 2015), involuntary excess reserves (Nguyen and Boateng, 2015), bank ownership (Drakos et al., 2016), securitisation activity (Delis and Kouretas, 2011; Maddaloni and Peydró, 2011), macroprudential policy (Maddaloni and Peydró, 2011, 2013) and corruption (Chen et al., 2015). Moreover, whilst evidence from the US reveals that the impact of monetary policy on banks'

appetite for risk is less pronounced for poorly capitalised banks (Dell'Ariccia et al., 2013), the opposite appears to hold in the case of Europe (Delis and Kouretas, 2011; Jiménez et al., 2014).

2.3.3 Synthesis of Review Findings

Taken together, the contributions reviewed in this paper portray a complex role of financial firms as vehicles for monetary policy transmission. Following the early studies acknowledging the importance of bank portfolios and—hence—bank credit for the propagation of monetary impulses, the literature has pointed to several mechanisms that are deemed to amplify the traditional interest rate channel. This review has discerned six major mechanisms through which monetary policy is transmitted to the real economy via financial firms: (1) the interest rate pass-through; (2) the credit channel; (3) the bank lending channel; (4) the balance sheet channel; (5) the bank capital channel; and (6) the risk-taking channel. Although disagreement exists with respect to the relative strength of the above channels, the evidence presented in this paper has established a number of conditions underpinning the different mechanisms. Broadly speaking, these conditions may be grouped into three primary categories: (1) firm-level (e.g. size, ownership and geographical location); (2) industry-specific (e.g. banking competition, market concentration and financial innovation); and (3) macroeconomic and regulatory (e.g. macroprudential policy, financial deregulation and corruption) variables.[21]

By combining each of the six mechanisms of monetary transmission with the three sets of conditions, one may obtain a comprehensive picture of the current state of knowledge in the field. Table 2.2 presents a multidimensional framework of the monetary transmission process via financial firms, where each of the 18 cells making up the framework includes a set of conditions that—according to the literature reviewed in this paper—are deemed to affect the functioning of the corresponding

[21] A model of the monetary transmission mechanism via financial firms as postulated by the literature reviewed in this paper is illustrated in Appendix Figure A.1.

mechanism. Whereas some of the factors influencing the ability of financial firms to act as conduits for monetary policy transmission appear to be specific to a given mechanism (e.g. product diversification for the interest rate pass-through and interest rate gap for the risk-taking channel), there is evidence consistent with other variables playing an important role across various channels. For instance, the literature shows that banking competition is not only a major determinant of the degree of interest rate pass-through, but also one of the factors affecting both the bank lending and risk-taking channels. At the same time, it is worth highlighting how some variables (e.g. securitisation activity and globalisation of banking operations) may produce differential effects on monetary policy transmission depending upon the channel being examined. Taken together, these findings point to the central role of financial firms in linking central bank interventions to economic outcomes, thus illustrating how policy stimulus can be mediated by organisational behaviour.

Table 2.2 Multidimensional Framework of the Monetary Transmission Mechanism via Financial Firms

	Mechanisms					
	Interest rate pass-through	Credit channel	Bank lending channel	Balance sheet channel	Bank capital channel	Risk-taking channel
Firm-level conditions	•Adjustment costs (Cottarelli and Kourelis, 1994; de Bondt, 2005; Fuertes et al., 2010; Heffernan, 1997; Hofmann and Mizen, 2004; Kopecky and VanHoose, 2012; Kwapil and Scharler, 2010) •Bank type (Chong et al., 2006; Heffernan, 1997) •Bank financial structure (De Graeve et al., 2007; Gambacorta, 2008) •Bank liquidity (Agénor and El Aynaoui, 2010; Gambacorta, 2008) •Bank capital (Fuertes et al., 2010; Gambacorta, 2008) •Relationship lending (Gambacorta, 2008; Kitamura et al., 2016) •Bank customer base (Hannan and Berger, 1991) •Credit risk (de Bondt, 2005) •Bank size (Chong et al., 2006) •Foreign funds (Égert et al., 2007) •Product diversification (Fuertes et al., 2010) •Profit volatility (Fuertes et al., 2010) •Geographical location (Montagnoli et al., 2016)	•Bank asset substitutability (Barth et al., 1977; Kashyap et al., 1993; Romer and Romer, 1990) •Bank size (Ciccarelli et al., 2015; de Bondt, 1998; Shearer, 1963) •Geographical location (Shearer, 1963) •Funding ability (Romer and Romer, 1990) •Real return to lending (Labadie, 1995) •Bank liquidity (de Bondt, 1998) •Bank health (Peek et al., 2003)	•Bank liquidity (Akinci et al., 2013; Breitenlechner et al., 2016; Chatelain et al., 2003; Diamond and Rajan, 2006; Ehrmann et al., 2003; Gambacorta, 2005; Hosono, 2006; Jiménez et al., 2012; Kashyap and Stein, 2000; Khan et al., 2016; Koch, 2015; Matousek and Sarantis, 2009; Yang and Shao, 2016) •Bank capital (Akinci et al., 2013; Altunbas et al., 2002; Breitenlechner et al., 2016; Gambacorta, 2005; Halvorsen and Jacobsen, 2016; Hosono, 2006; Jiménez et al., 2012; Khan et al., 2016; Kishan and Opiela, 2000; Koch, 2015; Yang and Shao, 2016) •Bank size (Breitenlechner et al., 2016; Brissimis et al., 2014; Favero et al., 1999; Hosono, 2006; Kashyap and Stein, 2000; Khan et al., 2016; Kishan and Opiela, 2000; Koch, 2015; Matousek and Sarantis, 2009; Ramos-Tallada, 2015) •Funding ability (Fama, 2013; Jayaratne and Morgan, 2000; Ramos-Tallada, 2015; Stein, 1998) •Bank ownership (Andries and Billon, 2010; Bhaumik et al., 2011; Ferri et al., 2014; Yang and Shao, 2016) •Market-based funding (Breitenlechner et al., 2016; Disyatat, 2011; Gambacorta and Marqués-Ibánez, 2011; Halvorsen and Jacobsen, 2016) •Internal capital markets (Campello, 2002; Cetorelli and Goldberg, 2012; Gambacorta, 2005) •Bank type (De Santis and Surico, 2013; Kakes and Sturm, 2002) •Relationship lending (Küppers, 2001) •Interest rate risk (Purnanandam, 2007) •Bank risk (Altunbas et al., 2010) •Involuntary excess reserves (Nguyen and Boateng, 2013) •Bank market power (Brissimis et al., 2014) •Security holdings (Koch, 2015)	•Bank size (de Bondt, 1998) •Internal capital markets (Ashcraft and Campello, 2007) •Bank capital (Popov, 2016)	•Interest rate risk (Gambacorta and Mistrulli, 2004; Van den Heuvel, 2002) •Bank size (Gambacorta and Mistrulli, 2004; Kishan and Opiela, 2006) •Funding composition (Bolton and Freixas, 2006) •Incentives to raise equity capital (Bolton and Freixas, 2006)	•Bank capital (Adrian et al., 2010; Adrian and Shin, 2010; Delis and Kouretas, 2011; Dell'Ariccia et al., 2013; Drakos et al., 2016; Jiménez et al., 2014; Maddaloni and Peydró, 2013; Popov, 2016) •Risk appetite (Adrian et al., 2010; Adrian and Shin, 2010; Borio and Zhu, 2012; Cociuba et al., 2016) •Bank liquidity (Borio and Zhu, 2012; Ioannidou et al., 2015; Maddaloni and Peydró, 2013) •Bank financial structure (Bruno and Shin, 2015; de Groot, 2014; Dell'Ariccia et al., 2014) •Bank type (Adrian and Shin, 2010; Buch et al., 2014) •Bank size (Brissimis et al., 2014; Kishan and Opiela, 2012) •Interest rate gap (Rajan, 2006) •Bank market power (Brissimis et al., 2014) •Foreign funds (Ioannidou et al., 2015) •Involuntary excess reserves (Nguyen and Boateng, 2015) •Bank ownership (Drakos et al., 2016)

Table 2.2 *(Continued)*

	Mechanisms					
	Interest rate pass-through	Credit channel	Bank lending channel	Balance sheet channel	Bank capital channel	Risk-taking channel
Industry-specific conditions	•Banking competition (Adams and Amel, 2011; Brämer et al., 2013; Chionis and Leon, 2006; de Bondt, 2005; De Graeve et al., 2007; Égert et al., 2007; Heffernan, 1997; Kleimeier and Sander, 2006; Kopecky and VanHoose, 2012; Perera and Wickramanayake, 2016) •Market concentration (Corvoisier and Gropp, 2002; Fuertes et al., 2010; Hannan and Berger, 1991; Neumark and Sharpe, 1992; Scholnick, 1996) •Financial structure (Cottarelli and Kourelis, 1994; Mojon, 2000; Sander and Kleimeier, 2004) •Financial distress (Aristei and Gallo, 2014; Hristov et al., 2014; Karagiannis et al., 2010)	•Financial frictions (Bernanke and Gertler, 1995; de Bondt, 1998; Romer and Romer, 1990) •Loan commitments (Morgan, 1998) •Financial structure (Ciccarelli et al., 2015)	•Banking competition (Fungácová et al., 2014; Khan et al., 2016; Leroy, 2014; Olivero et al., 2011a; Yang and Shao, 2016) •Financial innovation (Aysun and Hepp, 2013; Bernanke and Gertler, 1995; Gambacorta and Marqués-Ibánez, 2011) •Asset securitisation (Altunbas et al., 2009; Loutskina, 2011; Loutskina and Strahan, 2009) •Bank networks (Ehrmann and Worms, 2004) •Financial structure (Frühwirth-Schnatter and Kaufmann, 2006) •Banking consolidation (Olivero et al., 2011b) •Foreign bank penetration (Wu et al., 2011) •Banking globalisation (Cetorelli and Goldberg, 2012) •OBS banking (Perera et al., 2014)	•Asset securitisation (Aysun and Hepp, 2011) •Banking globalisation (Alpanda and Aysun, 2012) •Financial innovation (Alpanda and Aysun, 2012)	•Nature of the market for bank equity (Gambacorta and Mistrulli, 2004; Van den Heuvel, 2002) •Financial structure (Baglioni, 2007; Chami and Cosimano, 2010)	•Banking competition (Dell'Ariccia et al., 2014; Maddaloni and Peydró, 2013; Valencia, 2014) •Financial innovation (Borio and Zhu, 2012; Rajan, 2006) •Information asymmetries (Dell'Ariccia and Marquez, 2006) •OBS banking (Delis and Kouretas, 2011) •Asset securitisation (Maddaloni and Peydró, 2011) •Accounting practices (Borio and Zhu, 2012) •Financial distress (Dell'Ariccia et al., 2013) •Collateralised interbank borrowing (Cociuba et al., 2016)

Table 2.2 *(Continued)*

	Mechanisms					
	Interest rate pass-through	Credit channel	Bank lending channel	Balance sheet channel	Bank capital channel	Risk-taking channel
Macroeconomic and regulatory conditions	•Interest rate expectations (Kleimeier and Sander, 2006; Kopecky and VanHoose, 2012; Kwapil and Scharler, 2010, 2013) •Inflation rates (Égert et al., 2007; Hofmann and Mizen, 2004; Sander and Kleimeier, 2004) •Monetary policy transparency (Kleimeier and Sander, 2006; Liu et al., 2008; Perera and Wickramanayake, 2016) •Interest rate volatility (Sander and Kleimeier, 2004) •Government bond spreads (Cifarelli and Paladino, 2016) •Borrowing firms' balance sheets (Kitamura et al., 2016) •Central bank's financial strength (Perera and Wickramanayake, 2016) •Central bank independence (Perera and Wickramanayake, 2016) •Financial development (Perera and Wickramanayake, 2016) •Regulatory quality (Perera and Wickramanayake, 2016) •Rule of law (Perera and Wickramanayake, 2016) •Central bank's liquidity injections (Salachas et al., 2016)	•Bank-dependent borrowers (Bernanke and Blinder, 1992; Kashyap et al., 1993; Romer and Romer, 1990; Shearer, 1963) •Money demand shock (Bernanke and Blinder, 1988) •Deposit rate ceilings (Repullo and Suarez, 2000) •Borrower size (Ciccarelli et al., 2015) •Borrower type (Ciccarelli et al., 2015) •Central bank's liquidity injections (Orlowski, 2015)	•Financial deregulation (Bernanke and Gertler, 1995) •De jure deposit guarantees (Opiela, 2008) •Sovereign risk (Cantero-Saiz et al., 2014) •Deposit rate ceilings (Koch, 2015) •Market risk (Ramos-Tallada, 2015) •Interest rate volatility (Ramos-Tallada, 2015) •Central bank's liquidity injections (Salachas et al., 2016)	•Borrowers' net worth (Ashcraft and Campello, 2007; Aysun and Hepp, 2013; Bernanke and Gertler, 1995) •Loan demand (Bernanke and Gertler, 1995; de Bondt, 1998)	•Capital requirements (Baglioni, 2007; Bolton and Freixas, 2006; Cecchetti and Li, 2008; Chami and Cosimano, 2010; Gambacorta and Mistrulli, 2004; Kopecky and VanHoose, 2004; Peek and Rosengren, 1995; Thakor, 1996; Van den Heuvel, 2002) •Term structure of interest rates (Thakor, 1996)	•Macroprudential policy (Borio and Zhu, 2012; Maddaloni and Peydró, 2011, 2013) •Central bank's reaction function (Cao and Illing, 2015; de Groot, 2014; Farhi and Tirole, 2012) •Credit demand (Dell'Ariccia et al., 2014; Dell'Ariccia and Marquez, 2006) •Financial liberalisation (Borio and Zhu, 2012) •Monetary policy transparency (Kishan and Opiela, 2012) •Size of the monetary shock (Valencia, 2014) •Corruption (Chen et al., 2015)

Notes: The table details the mechanisms and conditions of the monetary transmission process through financial institutions according to the literature reviewed in this paper. The framework is based on the findings of 152 peer-reviewed journal articles published over the period from 1963 to 2016.

2.4 Discussion

As the results of the systematic review vividly highlight, the body of literature on the role played by financial firms in monetary policy transmission appears to be rather fragmented. All in all, the theoretical and empirical evidence tends to be clustered around channels of monetary transmission, with few attempts made by researchers to adopt a multi-channel approach. Furthermore, although the attention of scholars seems to be gradually shifting towards the implications of monetary policy for bank risk taking, most of the extant literature is still concentrated on the bank lending channel of monetary transmission. To the extent that this single-channel approach leads to the creation of new, separate sub-fields within each of the six areas identified in this review, the literature may become even more fragmented. Researchers might be interested in exploring a single phenomenon without considering the system as a whole. However, practitioners and policymakers need and should be provided with sound evidence that takes into account the overall complexity surrounding the system. My main contribution has been to integrate this fragmented body of knowledge into a comprehensive, multidimensional framework, thereby depicting a more inclusive view of the monetary transmission process via financial institutions. To my knowledge, the consolidating framework advanced in this paper represents the first attempt to comprehensively structure the research around the role of financial firms as vehicles for monetary policy transmission. It follows that such a framework can be used as a springboard for future quantitative and qualitative studies concerned with how central bank interventions are mediated by financial institutions' behaviour. By doing so, my hope is that not only can this review stimulate further research on this important topic, but that it also benefits practitioners and policymakers.

2.4.1 Research Agenda

This study points to several areas in need of further research. In light of the current period of exceptionally low interest rates, scholars could offer additional insights into how the interplay between monetary authorities and market regulators might shape the risk-taking incentives of financial firms. This work could shed light on whether monetary policy and the degree of concentration in the financial sector jointly affect credit risk appetite, thus possibly providing legitimacy to stricter antitrust regulations (e.g. how does market concentration impact on the risk-taking channel of monetary transmission?). Following the unprecedented measures taken by a number of central banks since the onset of the financial crisis, it would also be worth investigating the extent to which such measures alter the role of financial institutions as conduits for monetary policy transmission. Notwithstanding the empirical challenges, researchers could estimate the effects that purchases of assets owned by non-financial firms (i.e. 'quantitative easing') might have on the propagation of monetary impulses via the risk-taking channel (e.g. how does quantitative easing influence the risk-taking channel of monetary transmission?). Furthermore, a fruitful line of enquiry would be to explore how the formal institutional environment of a country might influence the monetary transmission process via financial intermediaries. On this front, a possible research avenue could be to use the comprehensive *Institutional Quality Dataset* proposed by Kuncic (2014) and examine the extent to which legal, political and economic institutions interact with central bank policies in determining financial firms' appetite for risk (e.g. to what extent does a country's institutional environment shape financial intermediaries' ability to act as vehicles for monetary policy transmission?). Finally, the field would benefit from a more micro-founded approach to the study of the factors underpinning differential responses by financial firms to monetary policy changes. For instance, future research might examine how various features of intermediaries' ownership structures influence the functioning of the risk-taking channel (e.g. how does man-

agerial compensation affect the transmission of monetary policy via the risk appetite of banks?). By departing from the extant literature, this research could take individuals (e.g. senior executives or loan officers) as the unit of analysis—instead of the whole organisation—and provide deeper insight into what drives risk appetite at financial firms. Indeed, this is an endeavour that seems to call for specific efforts on the part of management and organisation studies scholars.

2.4.2 Managerial Implications

The review findings have a number of implications for practitioners. A major area of interest to managers is to be found in the identification of a set of factors that may allow financial institutions to shield their loan supply from changes in monetary policy. For instance, the review presented in this paper has shown that banks establishing long-term relationships with customers and operating within bank networks may be able to insulate their loan portfolios better from fluctuations in interest rates. Second, a key managerial implication of this study lies in the provision of somewhat robust evidence on the link between monetary policy and bank risk taking. As a result, banks that raise the level of risk associated with their lending activities via a softening in credit standards should expect lower and more volatile profits, thereby potentially undermining their financial health. Third, the results of this review may increase practitioners' awareness of the role that their decisions play in ensuring a smooth functioning of the financial and economic system. This means that the consequences of their decisions on the whole system may become more transparent. As the preceding discussion hints, greater cognisance of how financial firms' responses to variations in central bank policies may foster or hinder economic growth is ultimately in the interest of financial firms.

2.4.3 Policy Implications

The framework developed in this paper points to a number of factors that should be accounted for in the central bank's reaction function. In light of the link between interest rates and financial firms' appetite for risk, the findings suggest that monetary policy indeed matters for financial stability. For this reason, this study lends support to the additional responsibilities of monetary authorities on macroprudential regulation and supervision, as epitomised by the new roles of the Federal Reserve and the European Central Bank (ECB) in monitoring systemic risk. Moreover, the framework highlights the implications of financial innovation—proxied by securitisation activity and banking globalisation—on the ability of financial firms to act as conduits for monetary policy transmission. As a result, it appears critical for central banks to monitor the developments in financial markets and to calibrate their policy actions accordingly. Third, there is evidence that a transparent and well-communicated monetary policy can not only strengthen the pass-through from official to retail rates, but also contribute to the overall stability of the financial system. It seems therefore imperative for monetary authorities to invest time and effort in ensuring an effective communication of their policies, whereby enhancing both the credibility and certainty surrounding future policy moves.

2.4.4 Limitations

As a first attempt to provide a systematic assessment of the literature on the role played by financial intermediaries in monetary policy transmission, it is acknowledged that this study is not free from limitations. First, following the decision to limit the analysis to peer-reviewed journals, it is conceivable that some potentially relevant articles might have been excluded from the sample. By means of the additional checks that were performed to account for the possible rigidity of the search strategy, it is nonetheless believed that the selected list of contributions covers the key studies in the field. Second, the analysis has been concerned with offering a

holistic view of the topic rather than a detailed account of the different sub-fields. While arguing that this feature represents at the same time one of the strengths of this paper, it is left for future research a deeper examination of one or more of the six strands of the literature identified in this study. Furthermore, another limitation might be associated with the overall generalisability of the findings. Given the predominant focus of the articles included in this review on either Europe or the US, caution should be taken when extending the conclusions of this paper to other economic contexts.

2.5 Conclusions

This paper set out to systematically review the literature on how the interplay between financial firms and monetary policy may shape economic outcomes, with the twofold aim of uncovering the mechanisms through which central bank interventions are transmitted to the economy via financial intermediaries and the conditions underpinning the functioning of these mechanisms. By conforming to the principles of the SLR methodology, this review found support for a multifaceted role of financial firms as vehicles for monetary policy transmission. My main contribution has been an integration of the current state of knowledge into a multidimensional framework, whereby a comprehensive picture of the monetary transmission process via financial institutions may be portrayed. A major lesson that can be drawn from the findings is that the response of financial firms to changes in monetary policy matters not only for economic performance, but also for the stability of the financial system.

While noting that the role of financial institutions in mediating the propagation of monetary impulses should be of great interest to management and organisation studies, this paper observed that the relevant scholarly debate is located primarily—and almost exclusively—between the fields of finance and monetary economics. As an 'eclectic' discipline (Zanko and Dawson, 2012), management is particularly well suited to providing richer insights into and progressing our understanding of this im-

portant area of research. For this reason, this study calls for management scholars to take up this challenge and make use of a variety of theoretical as well as research approaches that may allow for complementing the existing body of specialist knowledge. What is still largely concealed from the debate over the role of financial intermediaries as conduits for monetary policy transmission is that these phenomena are ultimately shaped by the actions and strategies of organisational agents. My hope is that the contribution advanced in this paper will help draw greater attention on the part of management scholars and reposition this topic within the scope of management and organisation studies.

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Appendix A

Table A.1 Inclusion and Exclusion Criteria

Criterion	Rationale
Inclusion	
Publication as a scholarly (peer-reviewed) journal article	A peer-reviewed journal article is likely to be of higher quality compared to non-scholarly types of publication such as working papers, conference proceedings or policy reports.
Publication in an academic journal with an Impact Factor greater than or equal to the Median Impact Factor for the relevant category (e.g. 'Business, Finance', 'Economics' and 'Management') according to the 2016 Journal Citation Reports® by Clarivate Analytics	The adoption of an Impact Factor threshold may allow to draw conclusions on the basis of a set of authoritative contributions, while providing a useful method for limiting the scope of the review.
Any publication date	Besides the lack of consensus among scholars with respect to the seminal work in the field, the major reason behind the decision not to include a starting date relates to the attempt to identify the pioneering studies in the area being reviewed.
Theoretical, conceptual or empirical paper	Although empirical research might constitute the most common approach to the phenomenon being studied, theoretical and conceptual articles play an essential role in advancing knowledge in the field.
All countries	The review aims to offer insights into the international academic debate on the topic being examined, thereby presenting literature concerned with a variety of geographical contexts.
Focus on the role played by financial firms in the monetary transmission mechanism	The purpose of the review is to shed light on the mechanisms through which monetary policy is transmitted to the real economy via financial firms and the conditions under which these mechanisms are operative.
Micro evidence	The analysis endeavours to uncover the micro-foundations of the monetary transmission mechanism by assessing the implications of financial firms' behaviour for monetary policy transmission.
Broad definition of monetary policy	In light of the different instruments and objectives adopted by central banks around the world, monetary policy is defined as any operation through which the monetary authority pursues its mandate by targeting either financial market prices (e.g. short-term interest rates) or financial market quantities (e.g. money supply).

Table A.1 *(Continued)*

Criterion	Rationale
Any type of financial institutions	Even though banking firms represent a key player within the monetary transmission mechanism, other types of financial institutions (e.g. broker-dealers, insurance companies and pension funds) may have an important role as vehicles for monetary policy transmission.
Exclusion	
Publication in a non-English language	A publication in a non-English language may not be accessible to a wider audience, thus possibly jeopardising the transparency and replicability of the review.
Commentary, editorial and literature or book review	Since the aim of the study is to provide recommendations based on either theoretical, conceptual or empirical papers, other forms of academic publications are excluded from the review and used as background information to assist with the analysis.
Non-financial firms	A study dealing with the role of non-financial firms in the monetary transmission mechanism does not address the review question and hence falls outside the scope of this paper.

Table A.2 Quality Appraisal Criteria

Area	Criterion
Research purpose	Is there an accurate description of what the research hopes to achieve and a clear account of the problem being studied? Does the article include a succinct statement of the research objectives or question(s)?
Theory	Does the article contain a well-developed theoretical framework and an explanation of what other authors' findings are being challenged or extended? Is there any major body of theory or important work that has been omitted?
Research design	Is there a comprehensive description of the research design? Would the information provided allow the replication of the research? If the article adopts new methods, are they explained in detail? Is the design suitable for answering the question(s) addressed? Are the sampling and data collection appropriate?
Data analysis	Is there a detailed account of data analysis? Is data analysis suitable for answering the question(s) addressed? Are the research findings presented clearly and in a logical sequence?
Argument and contribution	Is there sufficient information to support the claims being made? Does the article provide an indication of how the results relate to previous research? Is there an explanation of how the research findings move the body of scientific knowledge forward and contribute to policy/practice?

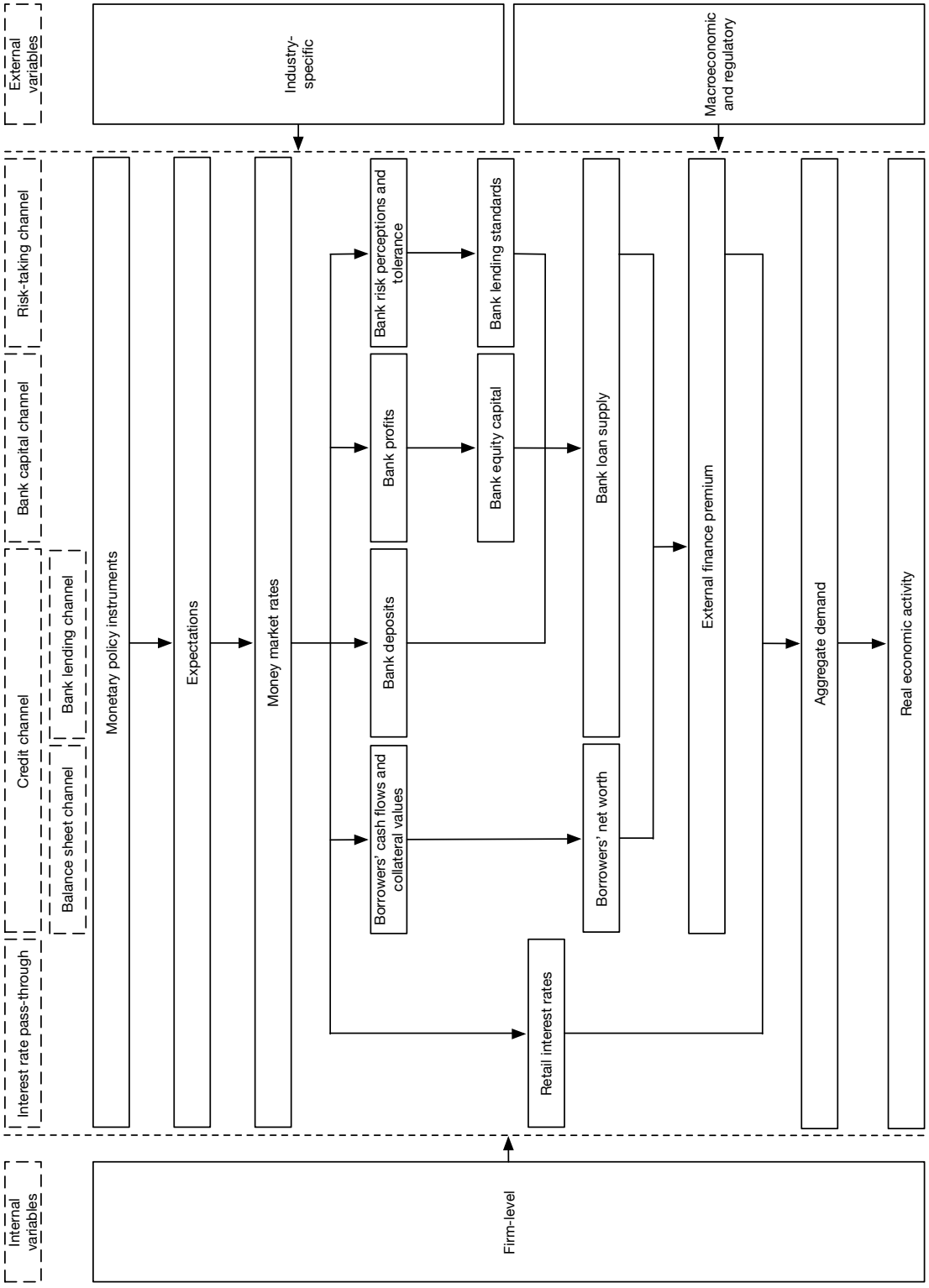

Figure A.1 Monetary Transmission Mechanism via Financial Firms

Chapter 3

Risk-Taking Channel of Monetary Transmission and Financial Stability: What Role for Stakeholder Banks?

Abstract

This paper examines how ownership structure interacts with monetary policy in shaping financial intermediaries' risk appetite. By constructing an unbalanced panel of commercial, cooperative and savings banks from 17 Western European countries over the 1999–2011 period, this study finds that differences in bank ownership influence the transmission of monetary policy via the risk-taking channel. While shareholder banks appear to adjust the riskiness of their portfolios more actively over the business cycle, there is evidence that the effects of lower interest rates on systemic risk are dampened by the presence of stakeholder banks. These results suggest that omitting ownership type may lead to incomplete conclusions about the impact of monetary actions on bank risk taking. From a policy perspective, the findings point to the systemic benefits to be derived from 'biodiverse' ownership structures in the European banking sector.

Keywords: Bank risk taking; financial crisis; monetary transmission mechanism; ownership structure; stakeholder banking; systemic risk.

3.1 Introduction

The global financial crisis has once again highlighted the wide-ranging implications of a sound financial system for real growth and economic welfare. What triggered this crisis and the ensuing economic contraction is likely to intrigue scholars and other observers for years (Acharya and Naqvi, 2012). A growing line of thought places the spotlight on monetary policy and the role it plays in influencing financial intermediaries' behaviour (Ioannidou et al., 2015; Jiménez et al., 2014). In the aftermath of the dot-com bust, a number of central banks throughout the world tackled fears of an economic slowdown by gradually decreasing nominal interest rates. By the mid-2000s, nominal rates had reached historically low levels. In the US, money market rates dropped from 6.26% in 2000 to 3.22% in 2005, with a record low of 1.13% in 2003. Similarly, in the euro area money market rates fell from 4.12% in 2000 to 2.09% in 2005, while in the UK they went down from 5.84% in 2000 to 4.68% in 2005. This 'too-low-for-too-long' interest rate environment—the theory goes—spurred risk taking by banks through changes in risk perception and aversion, thereby adding to the build-up of risks in the economy via a 'risk-taking channel' of monetary transmission (Borio and Zhu, 2012).

Notwithstanding the closer link between monetary conditions and bank risk taking, little has hitherto been the attention on how ownership structure interacts with monetary actions in influencing banks' appetite for risk. This is surprising, since standard property rights (Alchian and Demsetz, 1972) and agency (Jensen and Meckling, 1976) theories suggest that the type of ownership is a key determinant of firms' risk taking. In addition, whilst the banking literature abounds with attempts to quantify risk taking with respect to profit-maximising banks (i.e. 'shareholder banks'), there has been somewhat limited focus on the contribution of banks that pursue social as well as financial objectives (i.e. 'stakeholder banks') towards financial system stability (Hesse and Cihák, 2007). Such a void is at odds with the financial architecture of many European countries, in which shareholder banks

coexist with a substantial—sometimes even dominant—stakeholder banking sector (Ferri et al., 2013). For instance, this is the case in Germany, Italy and Austria, where customer-owned cooperatives and not-for-profit savings banks far outweigh in number their commercial peers. The debate over the benefits of a 'biodiverse' banking sector to ensure stability in the financial system has witnessed a renewed interest during most recent years, as stakeholder banks weathered the financial turmoil somewhat unscathed (Ayadi et al., 2009). A case in point is the high resilience exhibited by cooperative banks, which suffered a relatively small portion of the total losses incurred by European banks and hardly required government support (Groeneveld, 2011).[1]

Against this backdrop, the aim of this paper is to reconsider the role of stakeholder banks in monetary economics by examining how bank ownership affects the transmission of monetary policy via the risk-taking channel. This study intends to shed light on the implications that the interplay between monetary policy and ownership type has for banks' risk-taking incentives.[2] Broadly speaking, this article lies at the intersection of three major bodies of literature. It joins the growing discussion around the link between interest rates and banks' appetite for risk. As anticipated above, this strand of research provides empirical support for a risk-taking channel of monetary transmission operating through bank risk perception and tolerance (Ioannidou et al., 2015; Jiménez et al., 2014), yet it is silent on whether differences in ownership structure influence this transmission mechanism. Furthermore, this paper is related to the body of evidence on the implications of bank ownership for monetary policy effectiveness. As this line of enquiry shows (Drakos et al., 2016; Ferri et al., 2014), differences in ownership type indeed matter for the reactions of banks to monetary policy changes. My research also draws its theoretical founda-

[1] According to Groeneveld (2011), the cooperative banking sector is responsible for 8% of all direct losses and write-downs of European banks during the crisis, whilst UBS and HSBC alone accounted for 12% and 10%, respectively.

[2] To my knowledge, the only paper that accounts for differences in bank type—among other aspects—while examining the risk-taking channel of monetary policy is Jiménez et al. (2014).

tion from the literature on bank ownership and financial stability. Consistent with underlying differences in their ownership structure, empirical evidence suggests that stakeholder banks are generally more stable (Ayadi et al., 2010) and behave less cyclically (Meriläinen, 2016) than their shareholder counterparts.

This paper makes a threefold contribution. First, in responding to recent calls for a better understanding of banks' incentives to take on risk (Gambacorta and Marqués-Ibánez, 2011), this study brings concepts from the property rights (Alchian and Demsetz, 1972) and agency theory (Jensen and Meckling, 1976) perspectives into the analysis of the risk-taking channel. By estimating the differential effects of monetary interventions on bank risk taking owing to ownership structure, my findings present an enhanced picture of the role played by financial institutions as conduits of monetary policy transmission. Second, this article adds to the paucity of evidence on the functioning of the risk-taking channel during periods of financial distress.[3] As the sample includes the euro area sovereign debt crisis alongside the global financial crisis, it allows for the investigation of the extent to which risk-taking behaviours of banks with alternative types of ownership vary over the business cycle. Third, this research deals with the financial and economic benefits stemming from a diversity of ownership types in the banking sector (Ayadi et al., 2009; Ferri et al., 2013; Llewellyn, 2012). On this front, novel insights into how the interplay between monetary policy and ownership structure shapes banks' risk-taking incentives may be of particular interest to policymakers, especially in countries that are considering processes of mandatory conversion of financial cooperatives to limited company status (Casu and Gall, 2016).

The remainder of the article is organised as follows. Section 3.2 reviews the related literature and advances the theoretical predictions. Section 3.3 describes the process that was followed in selecting the sample and constructing the variables,

[3] A notable exception is Maddaloni and Peydró (2013), who use the answers from the *Bank Lending Survey* for the euro area and find that interest rates, together with long-term liquidity provision, led to a softening in lending standards even after the start of the 2008 crisis.

alongside the econometric model estimated. Section 3.4 illustrates the empirical results and discusses the implications, as well as limitations, of the findings. Section 3.5 concludes.

3.2 Literature Review

3.2.1 Monetary Policy and Bank Risk Taking

Fuelled by the recent economic downturn, a growing strand of the literature has pointed to an additional channel of monetary transmission operating through the risk-taking incentives of banks. According to Borio and Zhu (2012), changes in official rates affect either risk perception or tolerance via a risk-taking channel of monetary policy.[4] In a nutshell, this channel works via three primary mechanisms: (1) the impact of interest rates on valuations, incomes and cash flows (Borio and Zhu, 2012); (2) the existence of 'sticky' target rates of return (Rajan, 2006); and (3) the reaction function and communication policies of the central bank (Farhi and Tirole, 2012). Among these mechanisms, particular attention has been devoted by researchers to the link between interest rates and the search-for-yield effect. Simply put, this theory posits that a prolonged period of low interest rates may induce a degree of procyclical risk taking in the financial system (Rajan, 2006), eventually generating an equilibrium with deteriorated bank portfolios, lower and more volatile profits and higher aggregate credit (Dell'Ariccia and Marquez, 2006). Specifically, the relationship between interest rates and bank risk taking is shown to depend on the bank capital structure (Dell'Ariccia et al., 2014) and the size of the monetary shock (Valencia, 2014).

Drawing on the theoretical framework above, empirical evidence has recently started to explore the link between monetary policy and banks' appetite for risk. In

[4]An alternative explanation for monetary policy-induced changes in bank risk taking is put forward by Kishan and Opiela (2012), who identify a 'risk-pricing channel' of monetary transmission operating through the risk pricing of uninsured bank debt in the market for jumbo certificates of deposit.

what is generally viewed as one of the pioneering contributions in the field, Jiménez et al. (2014) use a micro-level dataset for Spain and find support for a risk-taking channel operating through less capitalised banks. In a similar vein, Ioannidou et al. (2015) focus on the Bolivian credit market and show that an expansionary monetary policy causes the granting of new loans to less creditworthy borrowers. By building a panel of 'shadow banks', broker-dealers and commercial banks for the US, Germany, UK and Japan, Adrian et al. (2010) uncover a joint dynamics between monetary conditions, intermediaries' appetite for risk and the macro risk premium.

In addition to these seminal studies, evidence of a risk-taking channel is found for both the US and European financial systems. Using US data for market-based financial intermediaries vis-à-vis commercial banks, Adrian and Shin (2010) submit that short-term interest rates are important in determining the balance sheet size of financial institutions. Further support for a risk-taking channel in the US is offered by Paligorova and Santos (2013), who collect data at the Bank Holding Company (BHC) level and find that banks charge riskier borrowers (compared to safer borrowers) lower loan spreads in periods of monetary easing than in periods of monetary tightening. Moreover, the relationship between policy rates and bank risk taking appears to be more pronounced for domestic banks of smaller size (Buch et al., 2014) and for better capitalised banks (Dell'Ariccia et al., 2013). Within the European context, early evidence of a link between interest rates and bank risk taking is put forward by Delis and Kouretas (2011), who construct a sample of commercial, savings and cooperative banks from 16 euro area countries and show that the impact of loose monetary policy on risk assets is amplified for banks with less equity capital as well as more Off-Balance-Sheet (OBS) items. Moreover, the strength of the risk-taking channel is found to be reduced by means of a more stringent prudential policy on either bank capital or the Loan-To-Value (LTV) ratio (Maddaloni and Peydró, 2013). Interestingly, the negative relationship between interest rates and bank risk seems to hold even if one considers somewhat more

heterogeneous samples (Altunbas et al., 2014; Maddaloni and Peydró, 2011).

3.2.2 Bank Ownership and Monetary Policy Transmission

In line with the revived interest in the ownership structure of banks and its implications for financial intermediation (Cull and Martínez Pería, 2013), a recent strand of research has begun to examine how banks with different types of ownership react to variations in monetary policy. By focusing primarily on the bank lending channel of monetary transmission (Bernanke and Blinder, 1988, 1992), this literature has been concerned with the consequences of bank ownership for the transmission of monetary impulses via the loan supply of banks. One of the first contributions in this area is advanced by Andries and Billon (2010), who develop a theoretical model to analyse the effects of state ownership and deposit insurance on monetary transmission. By considering a representative bank whose ownership is shared between the government and the private sector, Andries and Billon (2010) show that lending provided by state-owned banks tends to be less responsive to changes in monetary policy than lending provided by private banks due to the former's superior ability to raise additional deposits.

Turning to the empirical evidence, support for heterogeneous reactions of different types of banks to variations in the monetary policy stance is provided by Bhaumik et al. (2011). Drawing on bank-level data for India, Bhaumik et al. (2011) find that during periods of monetary tightening state-owned, old private—that is, privately owned banks that have been operating since well before the banking sector reforms introduced by the Indian government in 1992—and foreign banks cut back on lending following an increase in interest rates, whilst during periods of monetary easing higher interest rates are associated with a greater disbursal of credit only by old private banks. A different approach to studying the lending channel–bank ownership nexus is advanced by Ferri et al. (2014), who test for the existence of different lending policies between stakeholder- and shareholder-oriented banks. By employing

euro-area data over a period covering the global financial crisis, Ferri et al. (2014) offer evidence which suggests that stakeholder banks attempt to smooth financial conditions for their customers by adopting less procyclical lending policies—regardless of their financial situation or the general economic environment—than shareholder banks. A recent effort to take the ownership status of banks into account when estimating the link between interest rates and bank risk taking is presented by Drakos et al. (2016). On the basis of a panel of commercial, savings and cooperative banks from 10 Central and Eastern European (CEE) countries as well as Russia, Drakos et al. (2016) submit that the risk behaviours of foreign, well-capitalised banks from CEE countries appear to be more responsive to declining short-term rates than the risk behaviours of other banks in the sample.

3.2.3 Ownership Structure and Financial Stability

There is plenty of evidence in the literature suggesting that banks' ownership type has a bearing on their behaviour, performance and ultimate survival (Fama and Jensen, 1983; O'Hara, 1981; Rasmusen, 1988). While commercial banks are driven by maximisation of shareholder wealth, cooperative and savings banks strive to create value for a larger set of stakeholders. The distinguishing feature of cooperative banks is that they are owned by their members, thus implying the absence of any formal separation between owner-customers and non-owner-customers (Ayadi et al., 2010). Furthermore, members are entitled to only one vote, stakes are generally not marketable[5] and the distribution of profits is limited, consistent with cooperatives being built around an intergenerational endowment for the benefit of both current and future customers (Fonteyne, 2007; Groeneveld and Llewellyn, 2012). Like cooperatives, savings banks are not strictly profit-oriented institutions and are characterised by a dual financial and social mission (i.e. 'double bottom line') to serve the community in which they operate (Ayadi et al., 2009). However, savings

[5]In some cases, it is nonetheless possible for members to sell their ownership stakes back to the bank.

banks differ from cooperatives in that they are owned either by an organisation that belongs to the government or by a private foundation, suggesting that customers of savings banks have less ownership rights than those of cooperative banks (Ferri et al., 2013). For these reasons, it is unlikely that the property right structure of stakeholder banks will lead to profit-maximising behaviour (Amess, 2002). Similarly, the lower incentives for stakeholder banks to use leverage in an attempt to increase the expected return on equity (Ayadi et al., 2009), along with significant obstacles—at least for cooperative banks—in raising external capital (Ayadi et al., 2010), may make stakeholder banks less prone to risk taking (Llewellyn, 2017).

Consonant with theoretical predictions, empirical research points to a number of differences in the behaviour of stakeholder banks vis-à-vis shareholder banks. Drawing on Italian data over the 2007–2010 period, Bolton et al. (2013) find that banks oriented towards relationship lending charge higher spreads in normal times, but deliver stable lending at more favourable terms than transaction banks during a crisis. In addition, there is evidence that lending rates for banks other than cooperatives tend to increase with the length of the relationship for all customers, whereas in the case of cooperative banks this is true only for non-member customers (Angelini et al., 1998). Similarly, Foos (2009) focuses on Germany and provides evidence that cooperative and savings banks adjust their loan rates less cyclically compared to commercial banks. Using a sample of banks from 18 Western European countries, Meriläinen (2016) finds that the lending growth of cooperative and publicly owned savings banks was less affected by the global financial crisis and the subsequent sovereign debt crisis than that of commercial banks, while cooperative banks did not contribute to excessive lending in the run-up to the two crises.

Most importantly, the literature lends support to the view that stakeholder banks are major contributors to financial stability. In line with their 'stakeholder-value ethos' (Ayadi et al., 2009), early evidence from the US suggests that stakeholder banks are generally less risk-inclined than their shareholder peers. While O'Hara

(1981) finds that stock associations hold substantially higher amounts of Real Estate Owned (REO) property and rely more on borrowed funds than mutual associations, Verbrugge and Goldstein (1981) offer support for a poorer quality of the stocks' loan portfolio relative to mutuals. Moreover, there is evidence that stock firms exhibit higher concentration in those lines of business and geographic areas with the greatest risk (Lamm-Tennant and Starks, 1993), together with the adoption of high-risk strategies through an investment in risky assets and a mismatch between assets and liabilities (Esty, 1997).

Further support in favour of a different appetite for risk between stakeholder and shareholder banks is found in some countries in Europe, where the large presence of cooperative and savings banks alongside commercial banks has contributed to an increased interest by academics and policymakers in the stakeholder banking model (Groeneveld, 2011). Ayadi et al. (2009, 2010) compute Z-scores for six Western European countries and show that stakeholder banks are generally more stable than shareholder banks. Likewise, García-Marco and Robles-Fernández (2008) focus on the Spanish context and submit that savings banks have a lower insolvency risk than their commercial counterparts. In addition, empirical support is found for significant differences between the two ownership types in terms of loan quality, with stakeholder banks having lower non-performing loans (Beck et al., 2009) and loan loss provisions (Iannotta et al., 2007) compared to shareholder banks. Among the explanations for the relatively low levels of bad debts held by stakeholder banks is the lower branch manager turnover characterising these firms (Ferri, 1997), which may lead to improved customer relationships and greater ability to allocate loans. The higher stability of stakeholder banks compared to their shareholder peers is also confirmed by findings from a wider sample of developed countries (Hesse and Cihák, 2007), which emphasise the role played by the stakeholder banking sector in fostering financial stability. Therefore, it comes at no surprise that the discussion around the systemic benefits arising from a mix of ownership structures in the banking sector has

gained momentum over the last few years, especially in light of stakeholder banks' ability to navigate through the recent crisis relatively unaffected (Ayadi et al., 2009; Groeneveld, 2011).

Taken together, the three major bodies of literature reviewed above combine to make a key testable prediction, that is, bank ownership affects the transmission of monetary impulses via the risk-taking channel. Specifically, one may expect monetary policy to exert a greater impact on the risk appetite of shareholder banks vis-à-vis stakeholder banks. In other words, it is posited that the risk-taking behaviours of banks that strive to balance the interests of a multiplicity of stakeholders respond less to variations in monetary conditions relative to banks that focus almost exclusively on maximising shareholder wealth. To disentangle the effects of ownership type on bank risk taking, the econometric specifications include a number of other bank-level characteristics (e.g. size, capitalisation and profitability) that are deemed important by the literature in explaining risk-taking incentives at banks.

3.3 Data and Methodology

3.3.1 Sample Selection

The primary source of data is Bankscope, a global database of banks' financial statements and ownership structures maintained by Bureau van Dijk. To my knowledge, this is the most comprehensive database that allows comparisons of both listed and unlisted financial institutions worldwide.[6] I use annual report data for a panel of banks operating in 17 Western European countries, including 15 that joined the European Union before the 2004 accession (i.e. Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal,

[6]Although Bankscope provides balance sheet and income statement data in a global format, some differences in accounting practices—particularly for the period before the adoption of the International Financial Reporting Standards (IFRS)—may still exist. I attempt to account for these differences by including country and time fixed effects in the estimations.

Spain, Sweden and the UK) as well as Norway and Switzerland.[7] The validity of employing annual data when studying the risk-taking channel of monetary transmission is supported by Delis and Kouretas (2011), who build a quarterly dataset with information collected from Bloomberg and find that their results are not sensitive to the frequency of the underlying data.[8] The sample starts in 1999 (the year in which the euro was officially launched) and ends in 2011 (the last year for which data on the regulatory indices is available).[9] This time window is interesting, as it encompasses the global financial crisis alongside the eurozone sovereign debt crisis.

I started off with 10,375 financial intermediaries classified by Bankscope under the headings 'commercial banks', 'savings banks', 'cooperative banks', 'real estate and mortgage banks', 'specialised governmental credit institutions' and 'bank holdings and holding companies'. To mitigate survivorship bias, all active and inactive banks with at least one year of accounts between 1999 and 2011 were included.[10] To avoid double counting, I use data from unconsolidated statements if available, otherwise from consolidated statements.[11] I decided to work with unconsolidated accounts for two main reasons. First, the large majority of stakeholder banks included in the sample report at an unconsolidated level. Second, consolidated statements might end up duplicating the data (Micco et al., 2007). Furthermore, I ensured

[7]While the bulk of the observations comes from euro-area countries, unreported correlations of GDP growth and inflation across these countries point to significant heterogeneity in their business cycles.

[8]Further evidence suggesting that annual observations are sufficient to capture the effects of monetary policy on bank behaviour is presented by Ashcraft (2006) and Gambacorta (2005).

[9]The survey results used to construct the regulatory indices are available at four points in time (i.e. 2001, 2003, 2007 and 2011) and cover the period from 1999 to 2011. A discussion of the results can be found in Barth et al. (2013).

[10]Since Greece qualified to join the euro area in 2000 and was admitted in 2001, Greek banks enter the sample in 2001.

[11]Specifically, I consider financial statements with consolidation codes U1 (unconsolidated statement with no consolidated companion), U2 (unconsolidated statement with a consolidated companion) and U* (additional unconsolidated statement). Whenever banks do not report unconsolidated accounts, I employ consolidated statements C1 (consolidated statement with no unconsolidated companion), C2 (consolidated statement with an unconsolidated companion) and C* (additional consolidated statement). To prevent double entries, accounts with consolidation code A1 (aggregated statement with no companion) have been dropped.

subsidiaries were excluded. Intermediaries are considered at the institutional level, as many BHCs and holding companies may own financial firms of a different nature.

The most demanding part of the sample selection has been the categorisation of financial institutions into commercial, cooperative and savings banks. Following Ferri et al. (2013), I have initially reclassified UK and Irish building societies that survived the recent wave of consolidation and demutualisation as cooperative banks, since they are owned by—and run in the interests of—their members. The list of stakeholder banks has been extended to include a number of savings banks that have been found among the group of specialised governmental credit institutions, such as state-owned German *Landesbanken* or Swiss *Kantonalbanken*.[12] Moreover, several intermediaries that had been originally categorised as BHCs and holding companies have been added to the set of commercial banks. In a second step, the profile of each institution that was classified by Bankscope as either commercial, cooperative or savings bank has been examined.[13] This screening has led to a series of major refinements. I have changed the categorisation of most of the Swiss cooperatives in the Raiffeisen Group, as these had been classified as savings banks. Likewise, the specialisation of some of the German *Volksbanken* that had been found within the group of savings banks has been modified accordingly. I have also re-coded the ownership status of a number of savings banks in Belgium, Italy and Spain for which the private foundation ceased to be the ultimate owner. In addition, since the analysis requires deposit-taking and loan-making institutions, financial firms that cannot be reasonably considered as either commercial, cooperative or savings banks have been excluded.

To ensure that the results are not driven by Mergers and Acquisitions (M&As), I have reviewed the M&A history of all banks included in the sample. Consistent

[12]In line with the literature (Ayadi et al., 2009), savings banks were defined as financial intermediaries that are owned by either a municipality or a private foundation and have a primary mandate to serve the community in which they operate.

[13]Where the information provided by Bankscope is not sufficiently detailed, banks' individual websites alongside a variety of other sources have been accessed.

with the literature (Claessens and van Horen, 2014; Iannotta et al., 2013), banks that either merged with or were acquired by other entities remain in the sample until the year prior to the takeover, while from that year onwards only the accounts of the merged or acquiring bank have been kept. The information on M&A activity has been retrieved mainly from Bankscope, although in many instances it has been complemented by data collected from Thomson Reuters' SDC Platinum. After controlling for M&As, I have an unbalanced panel of 5,677 commercial, cooperative and savings banks. Table 3.1 shows the composition of the sample by country and ownership structure, while Figure 3.1 depicts the relative size of the stakeholder banking sector in each economy. The diversity of ownership types in European banking is epitomised by the cross-country differences in the number of stakeholder and shareholder banks. Whereas the German and Italian financial systems—among others—appear to be characterised by an overwhelming majority of stakeholder banks (92.34% and 74.39%, respectively), shareholder banks have a dominant presence in countries such as Luxembourg (96.92%) and the UK (69.72%). Besides Italy (68.92%) and Germany (67.29%), other countries that exhibit a large number of cooperative banks are Austria (52.45%) and Switzerland (45.55%). Savings banks are strongly present in the Scandinavian region, especially in Norway (85.52%) and Sweden (82.73%). In terms of total assets, the stakeholder banking sector is particularly large in Austria (58.10%) and Germany (55.73%), whilst it is relatively small in Belgium (1.65%) and Greece (3.24%). The greatest aggregate size of cooperative banks is found in France (37.61%) and savings banks constitute a major player in Spain (43.54%). Interestingly, the sum of total assets for the 148 Spanish cooperative and savings banks is almost twice the corresponding value for the 639 Italian stakeholder banks.

Table 3.1 Distribution of Banks by Country and Ownership Structure

	Shareholder		Cooperative		Savings		Stakeholder		Total	
	No.	TA	No.	TA	No.	TA	No.	TA	No.	TA
Austria	77	144.374	171	115.463	78	84.706	249	200.168	326	344.542
Belgium	52	966.652	12	9.748	11	6.443	23	16.191	75	982.843
Denmark	62	633.343	9	1.219	64	32.349	73	33.569	135	666.911
Finland	10	232.810	4	69.293	8	7.054	12	76.348	22	309.157
France	186	3107.848	165	1874.613	13	2.123	178	1876.736	364	4984.583
Germany	183	3467.631	1607	1046.405	598	3318.368	2205	4364.772	2388	7832.403
Greece	19	252.328	2	1.953	1	6.498	3	8.451	22	260.779
Ireland	23	536.213	3	21.046	0	0.000	3	21.046	26	557.258
Italy	220	1896.308	592	483.623	47	139.957	639	623.580	859	2519.888
Luxembourg	126	634.265	2	1.995	2	45.645	4	47.640	130	681.905
Netherlands	45	977.641	1	450.506	2	4.075	3	454.582	48	1432.223
Norway	19	225.838	2	1.631	124	98.534	126	100.164	145	326.002
Portugal	39	306.066	4	2.258	3	18.678	7	20.936	46	327.002
Spain	88	1242.678	87	84.357	61	1023.361	148	1107.717	236	2350.395
Sweden	19	556.229	0	0.000	91	21.009	91	21.009	110	577.238
Switzerland	159	1452.735	225	92.522	110	324.911	335	417.433	494	1870.168
UK	175	4481.792	68	401.634	8	3.025	76	404.659	251	4886.451
EA-12	1068	13 764.812	2650	4161.259	824	4656.907	3474	8818.166	4542	22 582.979
EU-15	1324	19 436.176	2727	4564.112	987	4713.291	3714	9277.403	5038	28 713.579
Total	1502	21 114.749	2954	4658.265	1221	5136.735	4175	9795.000	5677	30 909.749

Notes: The table shows the composition of the sample by country and ownership structure. *Shareholder* are commercial banks, while *stakeholder* include cooperative and savings banks. *TA* is the annual average of total assets in billions of US dollars. *EA-12* are the founding euro area countries, namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. *EU-15* are the economies that joined the European Union before the 2004 accession, that is, the *EA-12* countries plus Denmark, Sweden and the UK. The sample period goes from 1999 to 2011. *Sources*: Bankscope; author's calculations.

3.3.2 Variable Construction

3.3.2.1 Bank Risk Taking

The risk-taking behaviour of banks is measured with two proxies commonly used in the literature, namely the ratio of risk assets to total assets (*asset risk*) and the ratio of loan loss provisions to total loans (*credit risk*). Risk assets are calculated as the difference between total assets and the sum of loans and advances to banks, government securities and cash. Therefore, this ratio includes all assets with non-negligible credit and market risk (Gropp et al., 2011) and captures the overall riskiness of bank portfolios at any point in time (Delis and Kouretas, 2011). The loan loss provision

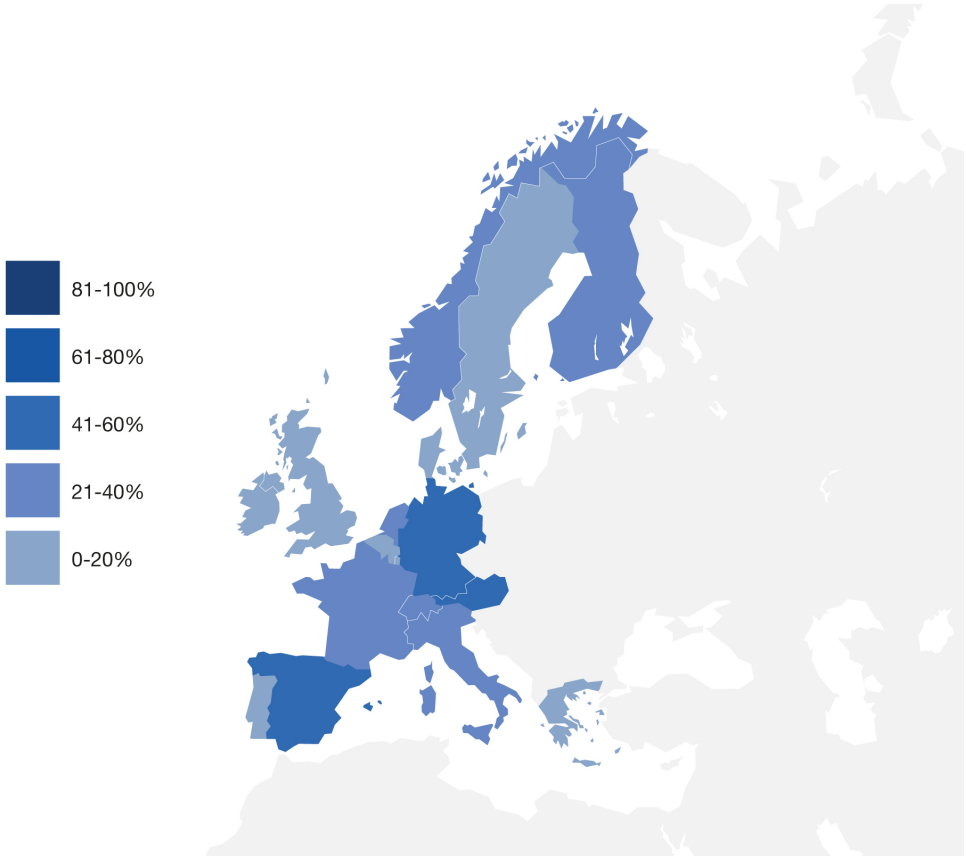

Figure 3.1 Size of the Stakeholder Banking Sector

Notes: The figure depicts the relative size of the stakeholder banking sector in each of the economies included in the sample. Percentage values refer to the annual average of total assets (in billions of US dollars) for stakeholder banks over the annual average of total assets for commercial, cooperative and savings banks in the country. Darker colours indicate greater size of the stakeholder banking sector vis-à-vis its shareholder counterpart. *Sources*: Bankscope; author's calculations.

variable is defined as the sum of provisions against possible losses on non-performing loans over net loans (i.e. residential mortgage loans, other mortgage loans, other consumer loans, corporate and commercial loans and other loans minus reserves for loan losses). This variable reflects the quality of loan portfolios (Bertay et al., 2015) and offers a more direct proxy for credit risk (Iannotta et al., 2007), with a higher ratio denoting a poorer credit quality. Therefore, these measures of bank risk taking describe the level of asset and credit risk taken on by banks in response to changing monetary conditions.

Data for the risk-taking proxies is collected from Bankscope and descriptive statistics are summarised in Table 3.2.[14] Over the sample period, *asset risk* has an average value of 80.256% and a standard deviation of 16.097%. The lowest mean value is observed in 1999 (76.746%) and the highest in 2004 (80.094%), suggesting a 4.36% increase in the average risk-taking behaviour of banks until the mid-2000s. In turn, *credit risk* is characterised by a mean of 0.684% and a standard deviation of 1.019%. While the credit risk appetite of banks seemed at its highest in 2002 (0.889%), it reached its lowest level in 2011 (0.278%). Table 3.3 presents summary statistics for the dependent variable by dividing the sample according to ownership type. At a first glance, one can notice several important differences among banks with alternative ownership structures. Whereas the average value of *asset risk* for stakeholder banks is higher than for their shareholder peers, the lower standard deviation for cooperative and savings banks implies less volatility in their risk-taking behaviours relative to commercial banks. On average, stakeholder banks are also characterised by a lower and less volatile credit risk compared to shareholder banks. Interestingly, the standard deviation of *asset* and *credit risk* for stakeholder banks (10.899% and 0.831%, respectively) is about half that for their shareholder counterparts (24.488% and 1.554%).

3.3.2.2 Monetary Policy

Since the onset of the global financial crisis, market observers have blamed the relatively low interest rate environment in the first half of 2000s for the softening of lending standards by banks and the subsequent materialisation of risks in the economy. More recently, a related discussion has ensued on whether the current environment of exceptionally low interest rates is already sowing the seeds for the

[14]To mitigate the impact of outliers, the accounting variables are winsorized at the first and 99th percentiles of their sample distributions.

Table 3.2 Descriptive Statistics

	Obs	Mean	SD	Min	Q1	Median	Q3	Max
Bank risk taking								
Asset risk	44271	80.256	16.097	7.965	75.931	84.844	90.606	99.460
Credit risk	44271	0.684	1.019	−5.480	0.198	0.533	0.951	10.000
Monetary policy								
Overnight rate	44271	2.508	1.386	−0.001	0.906	2.740	3.860	7.346
Bank-level controls								
Size	44271	6.512	1.690	2.481	5.357	6.285	7.454	12.462
Capitalisation	44271	8.379	6.317	1.074	5.002	6.684	9.821	79.114
Deposits	44271	87.512	13.489	35.690	83.135	93.086	97.020	99.615
Securitisation	44271	10.123	14.565	0.011	3.326	5.756	10.809	175.657
Profitability	44271	0.662	0.851	−5.202	0.299	0.541	0.917	7.891
Efficiency	44271	68.587	16.352	15.111	60.471	68.317	75.452	198.086
Income diversity	44271	0.494	0.194	0.000	0.375	0.485	0.606	0.979
Industry-specific controls								
Concentration	44271	992.130	891.137	329.211	433.597	662.005	944.727	6116.742
Activity restrictions	44271	6.704	2.796	2.000	5.000	7.000	9.000	12.000
Capital stringency	44271	6.131	1.596	2.000	5.000	6.000	8.000	9.000
Supervisory power	44271	9.584	2.214	4.000	8.000	10.000	11.000	14.000
Deposit insurance	44271	1.812	0.847	0.000	1.000	2.000	2.000	4.000
Private monitoring	44271	7.928	0.842	5.000	7.000	8.000	9.000	10.000
Macroeconomic controls								
Institutions	44271	1.362	0.371	0.346	1.240	1.457	1.586	1.986
GDP growth	44271	1.499	2.366	−8.864	0.707	1.711	3.270	8.442
Inflation	44271	1.728	0.849	−4.480	1.104	1.666	2.298	4.880
Volatility	44271	22.138	7.626	7.952	15.196	22.087	27.690	54.706
House prices	44271	1.230	4.067	−15.487	−1.745	0.466	3.818	18.992

Notes: The table summarises descriptive statistics for the main regression variables. *Asset risk* is the ratio of risk assets to total assets; *Credit risk* is the ratio of loan loss provisions to total loans; *Overnight rate* is the annual average of the daily overnight interbank rate; *Size* is the natural logarithm of real total assets; *Capitalisation* is the ratio of equity to total assets; *Deposits* is the ratio of deposits to total liabilities; *Securitisation* is the ratio of OBS items to total assets; *Profitability* is the ratio of profit before tax to total assets; *Efficiency* is the ratio of cost to total income; *Income diversity* is a measure of income diversification; *Concentration* is the Herfindahl–Hirschman Index of market concentration; *Activity restrictions* is an index of the extent to which banks can engage in a number of activities; *Capital stringency* is an index of the regulatory oversight of bank capital; *Supervisory power* is an index of the power of the supervisory authority to influence the behaviour on the part of banks; *Deposit insurance* is an index of each country's explicit deposit insurance regime; *Private monitoring* is an index of the degree to which regulatory and supervisory policies affect the private monitoring of banks; *Institutions* is a composite measure of country-level governance; *GDP growth* is the annual growth rate of real GDP; *Inflation* is the annual change in the CPI; *Volatility* is the annual average of the daily historical volatility of the country's stock market index; *House prices* is the annual change in the residential property price index (divided by the GDP deflator).

Table 3.3 Summary Statistics of Bank-Level Variables by Ownership Structure

	Shareholder		Cooperative		Savings		Stakeholder	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Asset risk	66.795	24.488	82.148	11.303	86.584	9.321	83.591	10.899
Credit risk	0.828	1.554	0.653	0.777	0.638	0.934	0.648	0.831
Size	7.379	1.980	5.949	1.408	7.019	1.542	6.297	1.537
Capitalisation	11.340	10.750	7.747	4.113	7.434	4.648	7.645	4.297
Deposits	85.745	14.327	87.324	14.280	89.249	10.638	87.950	13.237
Securitisation	19.476	25.195	7.669	8.289	8.089	10.232	7.806	8.969
Profitability	0.932	1.489	0.592	0.540	0.603	0.646	0.595	0.577
Efficiency	67.972	26.928	70.132	12.391	65.849	11.930	68.739	12.406
Income diversity	0.561	0.255	0.486	0.180	0.459	0.153	0.478	0.172

Notes: The table presents summary statistics for the bank-specific variables by dividing the sample according to ownership type. *Shareholder* are commercial banks, while *stakeholder* include cooperative and savings banks. *Asset risk* is the ratio of risk assets to total assets; *Credit risk* is the ratio of loan loss provisions to total loans; *Size* is the natural logarithm of real total assets; *Capitalisation* is the ratio of equity to total assets; *Deposits* is the ratio of deposits to total liabilities; *Securitisation* is the ratio of OBS items to total assets; *Profitability* is the ratio of profit before tax to total assets; *Efficiency* is the ratio of cost to total income; *Income diversity* is a measure of income diversification.

next financial crisis (Dell'Ariccia et al., 2013). For this reason, the main measure of monetary policy used in this paper is the short-term interest rate (*overnight rate*), computed as the annual average of the daily overnight interbank rate. Figure 3.2 illustrates the movements in money market rates in the period from 1999 to 2011. Looking at the time window before the outbreak of the crisis, there is evidence of strong cross-country commonalities in the conduct of monetary policy, as overnight rates declined considerably in all economies included in the sample and reached their lowest levels around 2005. During this period, money market rates were particularly low in Switzerland (with an average value of 0.17% in 2003) and dropped substantially in Norway (with an annual decrease of 52.09% between 2003 and 2004).

In the wake of the credit crisis, policy rates were rapidly lowered towards the zero lower bound. After the collapse of Lehman Brothers in the third quarter of 2008, many central banks attempted to provide financial and economic stability by implementing an unprecedented set of non-standard monetary policy measures. As a result, central bank balance sheets in many advanced economies expanded sharply,

largely reflecting the increase in the amount of liquidity provided to the banking sector (Gambacorta et al., 2014). Between 2008 and 2011, the assets of the Bank of England tripled, while the size of the balance sheets of the Eurosystem and the Swiss National Bank doubled. Significant was also the growth in the asset size of the Sveriges Riksbank and the Danmarks Nationalbank, whereas the Norges Bank expanded its balance sheet only in the period following the Lehman bankruptcy.[15] To disentangle the effects of these measures on bank riskiness from those due to variations in short-term rates, the estimations for the crisis period also include the ratio of central bank assets to nominal GDP (*central bank assets*) as a proxy for unconventional monetary policy.[16]

3.3.2.3 Control Variables

To avoid omitted-variable bias, I control for a number of bank-level, industry-specific and macroeconomic factors that might affect banks' appetite for risk. At the micro level, I account for a possible 'too-big-to-fail' phenomenon by including bank size (*size*), defined as the natural logarithm of real total assets.[17] Although the existence of a relationship between bank size and risk is well documented in the literature, its sign appears to be fairly ambiguous (Iannotta et al., 2007; Mohsni and Otchere, 2014). Similarly, there is some evidence that banks with higher capital invest in riskier projects (Williams, 2014), whilst other studies find a more prudent behaviour by well-capitalised intermediaries (Delis and Kouretas, 2011). Therefore,

[15]For the Norges Bank, central bank assets are calculated as total assets minus investments in the *Government Pension Fund Global* (Gambacorta et al., 2014).

[16]As a robustness check, the unconventional monetary policy instrument is captured using the ratio of monetary base to nominal GDP. Since there is evidence that central bank assets are a better gauge of non-standard monetary policy than the monetary base (Gambacorta et al., 2014), the former is used in the benchmark specifications. Although support for the use of central bank assets and the monetary base as measures of unconventional monetary policy is found in the literature (Fungácová et al., 2014; Gambacorta and Marqués-Ibánez, 2011), it is acknowledged that these proxies may not capture the qualitative component of non-standard interventions (i.e. 'qualitative easing').

[17]To ensure comparability across banks, all balance sheet and income statement data are converted to US dollars using the relevant exchange rates at each closing date.

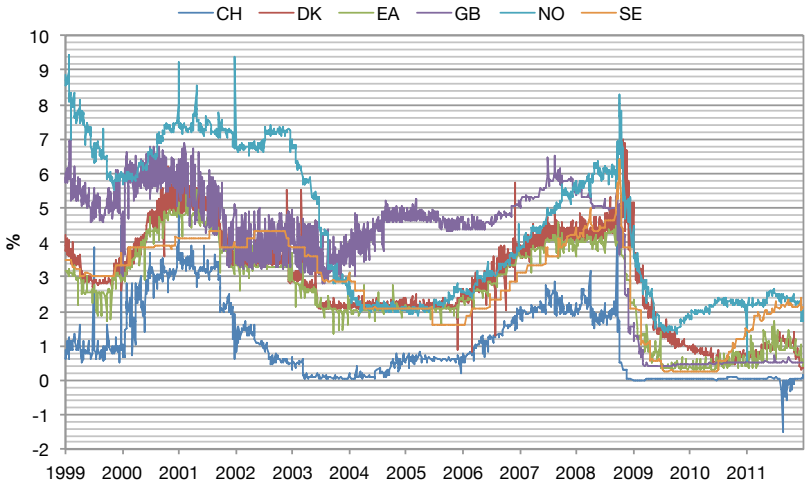

Figure 3.2 Overnight Interbank Rates

Notes: The figure illustrates the movements in money market rates in the period from 1999 to 2011. CH, Switzerland: call money rate; DK, Denmark: tomorrow/next rate; EA, euro area: Euro OverNight Index Average (EONIA); GB, United Kingdom: Sterling OverNight Index Average (SONIA); NO, Norway: Norwegian Overnight Weighted Average (NOWA); SE, Sweden: tomorrow/next STockholm InterBank Offered Rate (STIBOR). *Sources*: Datastream; national data.

these conflicting predictions are tested for by considering the ratio of equity to total assets (*capitalisation*). As recent empirical evidence suggests that banks' ability for funding is important in explaining their risk positions (Altunbas et al., 2014; Fiordelisi and Marqués-Ibánez, 2013), I control for the liability structure of intermediaries' balance sheets. For this purpose, the deposits-to-total-liabilities ratio (*deposits*) is used. Likewise, the shift from the traditional 'originate-to-hold' to the 'originate-to-distribute' model observed over the last two decades may have reduced banks' funding needs in the event of a monetary tightening (Altunbas et al., 2009), thereby leading to a change in their risk exposure (Loutskina, 2011). To proxy for asset securitisation (*securitisation*), the ratio of OBS items to total assets is included.[18] Furthermore, the ratio of profit before tax to total assets is added as a measure of bank profitability (*profitability*). It is argued that poorly performing in-

[18]Taken together, the above characteristics may also allow for the disentangling of the risk-taking channel from the partially overlapping bank lending channel (Bernanke and Blinder, 1988, 1992).

termediaries have reasons to embark in riskier activities to regain profitability (Casu et al., 2011), while a positive link appears to exist when current profits are used to expand the proportion of assets carrying credit and market risk (García-Marco and Robles-Fernández, 2008). In turn, technically efficient banks may have a better ability to manage risk and—ceteris paribus—a greater willingness to adopt risky balance sheets (Drakos et al., 2016), whereas the opposite appears to hold as lower efficiency seems to encourage banks to take on greater risk in an attempt to generate profits (Dong et al., 2014). Bank efficiency (*efficiency*) is proxied by the cost-to-income ratio, with higher values indicating less efficient operations. As empirical findings show that diversification away from traditional lines of business influences bank risk taking (Beltratti and Stulz, 2012; Hesse and Cihák, 2007), I also include a variable to control for differences in banks' income (*income diversity*). Building on Laeven and Levine (2007), this variable is calculated as follows:

$$Income\ diversity = 1 - \left| \frac{Net\ interest\ income - Other\ operating\ income}{Total\ operating\ income} \right| \quad (3.1)$$

The set of industry-related controls comprises the Herfindahl–Hirschman Index as a proxy for market concentration (*concentration*), computed as the sum of squared market shares of all banks in a country.[19] I do not have a clear assumption about the concentration–risk nexus, since the literature suggests that more concentrated markets are conducive to either higher or lower levels of banking stability (Beck et al., 2006; Schaeck et al., 2009). To capture the regulatory environment, five indices are constructed using data from the *Bank Regulation and Supervision Survey* (BRSS) conducted by the World Bank and described in Barth et al. (2001, 2004, 2006, 2012). *Activity restrictions* measures the extent to which banks can engage in a number of activities (e.g. securities underwriting, brokering and dealing), with

[19] In alternative specifications, the Lerner Index is used as a direct measure of market power, computed following the approach in Demirgüç-Kunt and Martínez Pería (2010).

higher numbers indicating more regulatory impediments on non-lending activities. Restrictions on the operations of financial institutions either discourage risk taking (García-Kuhnert et al., 2015) or increase the fragility of the system by preventing banks from diversifying outside their traditional lines of business (Beck et al., 2006). *Capital stringency* proxies for the regulatory oversight of bank capital, with higher values denoting more stringent guidelines on the nature and sources of regulatory capital. While stricter capital regulations are often negatively related to bank risk due to the option value of deposit insurance (Keeley and Furlong, 1990), greater capital stringency may lead banks to adjust their portfolios towards riskier structures through a decrease in leverage (Kim and Santomero, 1988). *Supervisory power* reflects the right of the supervisory agency to take actions such as forcing banks to change their organisational structures, suspending directors' decisions to distribute dividends and declaring insolvency, with a higher index implying greater supervisory power. From a theoretical perspective, one would expect more supervisory power to constrain risk-taking incentives by banks, although empirical studies show conflicting findings (Delis and Kouretas, 2011; Lee and Hsieh, 2013). *Deposit insurance* captures each country's explicit deposit insurance regime, with greater values pointing to higher protection of depositors in case of bank default. In light of the moral hazard problem induced by deposit insurance (Angkinand and Wihlborg, 2010; Forssbaeck, 2011), I anticipate a positive relationship between the aforementioned index and intermediaries' appetite for risk. *Private monitoring* shows the degree to which regulatory and supervisory policies affect the private monitoring of banks—in this case, higher numbers reflect greater incentives for market discipline. I do not have a strong prior on this index, as the literature submits that higher incentives to scrutinise financial institutions on the part of the private sector can either encourage or curtail risk taking by banks (Beltratti and Stulz, 2012; Delis and Kouretas, 2011).

At the country level, I account for an array of institutional and macroeconomic variables that are likely to influence the risk-taking choices of banks. Since there

is evidence that greater institutional development contributes to financial stability (Beck et al., 2006; Hesse and Cihák, 2007), the econometric estimations include a composite measure of country-level governance (*institutions*) constructed using the *Worldwide Governance Indicators* (WGI) by Kaufmann et al. (2010).[20] Following Beltratti and Stulz (2012), I average the six indicators (i.e. 'voice and accountability', 'political stability and absence of violence', 'government effectiveness', 'regulatory quality', 'rule of law' and 'control of corruption') into a single index per country. As a wealth of studies suggests (Chalermchatvichien et al., 2014; Lee and Hsieh, 2013), general economic conditions have a bearing on the riskiness of financial intermediaries. For this reason, I control for the growth rate of real GDP (*GDP growth*) and the annual change in the CPI (*inflation*). Furthermore, I capture developments in stock markets by computing a measure of share price volatility (*volatility*), calculated as the annual average of the daily historical volatility of a country's stock market index.[21] To the extent that improvements in stock markets promote riskier budgets and present banks with incentives to take on additional risks (Borio and Zhu, 2012; Paligorova and Santos, 2013), a negative link between the volatility proxy and banks' appetite for risk is hypothesised. Finally, the empirical setup aims to distinguish the risk-taking channel from the standard 'financial accelerator' à la Bernanke et al. (1999), given that easing monetary conditions might lead banks to expand their lending due to increases in borrowers' net worth (Matsuyama, 2007). Hence, the annual change in the residential property price index (divided by the GDP deflator) is included as a measure of the value of borrowers' collateral (*house prices*). Table 3.4 reports the correlation coefficients for the set of explanatory variables, suggesting that multicollinearity is unlikely to affect the

[20] Alternatively, institutional quality is also proxied using the *Corruption Perceptions Index* by Transparency International, which scores countries based on how corrupt their public sector is perceived to be.

[21] In unreported regressions, stock market conditions are captured by the annual change in the total return index (divided by the GDP deflator).

parameter estimates.[22]

[22]Definitions and sources of all variables used in the analysis are detailed in Appendix Table B.1.

Table 3.4 Correlation Matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1)	1.000																		
(2)	−0.023	1.000																	
(3)	−0.003	−0.281	1.000																
(4)	−0.004	−0.092	−0.225	1.000															
(5)	0.079	0.179	0.178	−0.164	1.000														
(6)	0.073	−0.056	0.344	−0.113	0.166	1.000													
(7)	0.022	−0.212	0.018	0.066	−0.111	−0.491	1.000												
(8)	0.049	0.257	−0.051	0.061	0.151	0.003	0.058	1.000											
(9)	−0.236	−0.039	0.106	−0.022	0.008	0.095	−0.092	−0.169	1.000										
(10)	0.150	−0.008	0.204	−0.477	0.205	0.168	−0.034	0.037	0.004	1.000									
(11)	−0.314	0.146	−0.078	0.150	−0.113	−0.067	−0.066	−0.023	0.119	−0.413	1.000								
(12)	−0.335	0.007	−0.076	0.048	−0.146	−0.093	−0.043	−0.110	0.301	−0.312	0.463	1.000							
(13)	0.005	0.063	0.011	−0.005	0.109	0.064	−0.035	−0.057	0.103	−0.015	0.191	0.110	1.000						
(14)	−0.151	0.088	0.033	0.019	0.000	−0.022	0.011	0.097	0.012	0.077	0.126	−0.252	−0.268	1.000					
(15)	0.018	−0.040	−0.157	0.510	−0.120	−0.030	−0.049	−0.050	0.439	−0.540	0.101	0.213	−0.054	−0.125	1.000				
(16)	0.249	−0.005	−0.001	0.094	0.038	0.108	−0.072	0.041	0.074	0.009	−0.034	−0.077	0.069	−0.151	0.205	1.000			
(17)	0.463	0.061	0.113	−0.147	0.144	0.026	−0.011	0.047	−0.151	0.234	−0.062	−0.186	0.006	0.063	−0.300	0.289	1.000		
(18)	0.129	0.007	−0.047	0.065	−0.055	−0.149	0.088	−0.056	−0.122	−0.261	0.022	0.155	0.065	0.035	−0.029	−0.470	0.104	1.000	
(19)	0.033	0.079	0.151	−0.087	0.201	0.200	−0.100	0.095	0.118	0.144	−0.022	−0.134	0.127	−0.066	−0.059	0.380	0.153	−0.255	1.000

Notes: The table reports the correlation coefficients for the main explanatory variables. (1) *Overnight rate*: annual average of the daily overnight interbank rate; (2) *Size*: natural logarithm of real total assets; (3) *Capitalisation*: ratio of equity to total assets; (4) *Deposits*: ratio of deposits to total liabilities; (5) *Securitisation*: ratio of OBS items to total assets; (6) *Profitability*: ratio of profit before tax to total assets; (7) *Efficiency*: ratio of cost to total income; (8) *Income diversity*: measure of income diversification; (9) *Concentration*: Herfindahl–Hirschman Index of market concentration; (10) *Activity restrictions*: index of the extent to which banks can engage in a number of activities; (11) *Capital stringency*: index of the regulatory oversight of bank capital; (12) *Supervisory power*: index of the power of the supervisory authority to influence the behaviour on the part of banks; (13) *Deposit insurance*: index of each country's explicit deposit insurance regime; (14) *Private monitoring*: index of the degree to which regulatory and supervisory policies affect the private monitoring of banks; (15) *Institutions*: composite measure of country-level governance; (16) *GDP growth*: annual growth rate of real GDP; (17) *Inflation*: annual change in the CPI; (18) *Volatility*: annual average of the daily historical volatility of the country's stock market index; (19) *House prices*: annual change in the residential property price index (divided by the GDP deflator).

3.3.3 Econometric Model

The equation to be estimated has the following functional form:

$$y_{i,k,t} = \alpha + \beta y_{i,k,t-1} + \eta x_{k,t} + \theta x_{k,t} \times z_{i,k} + \lambda \boldsymbol{W}_{i,k,t} + \tau \boldsymbol{U}_{k,t} + \phi_k + \psi_t + \varepsilon_{i,k,t} \quad (3.2)$$

with $i = 1, ..., N$, $k = 1, ..., 17$ and $t = 1, ..., T$, where N is the number of banks, k is the country and T is the final year. Although it is acknowledged that shareholder- and stakeholder-oriented banks are to some extent different in each of the selected countries, the use of panel data appears to be well suited to my empirical setting as it allows to control for individual heterogeneity as well as to study the dynamics of adjustment (Baltagi, 2013). The dependent variable, $y_{i,k,t}$, for bank i headquartered in country k at time t is proxied by either *asset risk* or *credit risk*.[23] Since evidence is found of a relatively high persistence of risk over time (Delis and Kouretas, 2011; Jiménez and Saurina, 2006), the lagged dependent variable is included among the regressors. The variable $x_{k,t}$ is the main measure of monetary policy, namely the overnight interbank rate. In line with the risk-taking channel literature (Borio and Zhu, 2012; Dell'Ariccia et al., 2014), the coefficient η is expected to be negative. The differential effects of interest rates on banks' appetite for risk owing to ownership structure are captured by interacting the monetary policy variable with an ownership dummy, $z_{i,k}$, which equals 1 for stakeholder banks as a group (or for cooperative and savings banks separately) and 0 otherwise. To address multicollinearity issues due to the inclusion of the multiplicative term alongside the interest rate variable, the latter variable is mean-centred prior to forming the product term.[24] Consistent

[23] As *asset risk* is bounded between 0 and 100, I allow the dependent variable to range from negative to positive infinity by employing its logarithmic transformation (i.e. $\ln\left[y_{i,k,t}/\left(100 - y_{i,k,t}\right)\right]$). Similarly, the credit quality variable is constructed as the natural logarithm of the ratio between loan loss provisions and total loans to reduce the skewness of the *credit risk* distribution.

[24] The ownership dummy is not listed separately in Equation 3.2 due to the severe multicollinearity between the dummy and its interactive term with the monetary policy variable.

with the theoretical predictions advanced in Section 3.2, I anticipate the parameter θ to be positive. As central banks loosen monetary conditions, cooperative and savings banks are expected to take on less risk when compared with their commercial peers. The bank-specific controls are contained in the vector $\boldsymbol{W}_{i,k,t}$, while $\boldsymbol{U}_{k,t}$ represents the set of industry- and macro-level variables. To account for unobserved country-specific factors and time-varying common shocks that may influence bank risk taking, all econometric specifications include country, ϕ_k, as well as time, ψ_t, fixed effects.

The estimation of Equation 3.2 presents a number of empirical challenges. A major identification limitation when examining the monetary policy–bank risk taking nexus is that monetary conditions might be endogenous to the risk observed in the banking sector (Jiménez et al., 2014). Within this context, an endogeneity problem can arise if monetary policy actions are also determined by financial stability objectives. This might be particularly true since the onset of the financial crisis, as central banks' concerns regarding the financial situation of the banking sector led to a rapid expansion on the set of conventional and unconventional policy measures (Altunbas et al., 2014). Although one can expect endogeneity not to be a major concern in the sample countries, given that their central banks have primarily an inflation-targeting objective, this potential issue is mitigated further by the use of an appropriate econometric method. From an econometric standpoint, endogeneity implies that the interest rate variable, $x_{k,t}$, may be correlated with the error term, $\varepsilon_{i,k,t}$, thereby potentially biasing my estimates. In addition, the inclusion of the lagged dependent variable on the right-hand side may induce autocorrelation in the residuals and render the Ordinary Least Squares (OLS) estimator biased and inconsistent even if the idiosyncratic errors are not serially correlated (Baltagi, 2013). To obtain consistent and unbiased estimates of the interplay between monetary policy, ownership structure and bank risk taking, the econometric model is estimated using the dynamic Generalised Method of Moments (GMM) introduced

by Holtz-Eakin et al. (1988) and Arellano and Bond (1991) and further developed by Arellano and Bover (1995) and Blundell and Bond (1998).[25] By building a 'stacked' system of equations in both levels and differences, this estimator allows to control for unobserved heterogeneity, simultaneity and the dynamic relationship between past realisations of the dependent variable and current values of the explanatory variables (Wintoki et al., 2012). Therefore, it ensures the efficiency and consistency of the estimated parameters (Gambacorta and Marqués-Ibánez, 2011), provided that there is no second-order serial correlation and the instrument set is valid.

In line with Arellano and Bover (1995) and Blundell and Bond (1998), endogenous and predetermined variables are instrumented by their own lags in levels in the first-difference equation and by their lagged first differences in the level equation, while exogenous regressors are instrumented by themselves. This generates a system of equations that takes the following form:

$$\begin{aligned}\begin{bmatrix} y_{i,k,t} \\ \Delta y_{i,k,t} \end{bmatrix} = \alpha + \beta \begin{bmatrix} y_{i,k,t-1} \\ \Delta y_{i,k,t-1} \end{bmatrix} + \eta \begin{bmatrix} x_{k,t-j} \\ \Delta x_{k,t-j} \end{bmatrix} + \theta \begin{bmatrix} x_{k,t-j} \times z_{i,k} \\ \Delta x_{k,t-j} \times z_{i,k} \end{bmatrix} \\ + \lambda \begin{bmatrix} \boldsymbol{W}_{i,k,t-j} \\ \Delta \boldsymbol{W}_{i,k,t-j} \end{bmatrix} + \tau \begin{bmatrix} \boldsymbol{U}_{k,t-j} \\ \Delta \boldsymbol{U}_{k,t-j} \end{bmatrix} + \phi_k + \psi_t + \varepsilon_{i,k,t} \end{aligned} \tag{3.3}$$

where j is the number of lags. Besides the lagged dependent and the monetary policy variables, I treat as endogenous all bank-specific characteristics with the exception of *size*. This means that for endogenous variables their second and further lags are available as instruments, while first and deeper lags can be employed for variables that are predetermined but not strictly exogenous. I consider as predetermined the set of regulatory indices, implying that banks are aware of their size and

[25] The 'system GMM' is preferred over the 'difference GMM' due to the improvement in efficiency when the autoregressive parameter is particularly high and the time-series dimension of the underlying data is moderately small (Blundell and Bond, 1998).

the regulatory environment when deciding the level of risk taking to adopt.[26] To avoid overfitting, the proxy for market concentration and all macroeconomic controls are taken as exogenous. Following Roodman (2009), instrument proliferation is prevented by using a collapsed instrument matrix and limiting lag depth.[27] I use the two-step estimator with Windmeijer (2005) finite-sample corrected standard errors clustered by bank.

3.4 Results and Discussion

3.4.1 Main Estimations

Table 3.5 presents the results of the main empirical estimations when stakeholder banks are considered as a group.[28] The Arellano–Bond test for autocorrelation in the errors rejects the presence of second-order serial correlation, $AR(2)$, while the Hansen test of overidentifying restrictions confirms the validity of the instrument set. The estimations for the full period are reported in the first two columns of Table 3.5, where bank risk taking is proxied by either *asset risk* or *credit risk*.[29] The coefficient on *overnight rate* is negative and strongly significant under both specifications, suggesting that lower interest rates alter the composition of commercial banks' portfolios towards riskier positions. In a nutshell, this evidence is consistent with a risk-taking channel that operates via the risk decisions of shareholder banks. The interaction term between monetary policy and the stakeholder bank dummy has a positive and highly significant coefficient, indicating that the effects of monetary

[26] A similar treatment of endogenous and predetermined variables in risk equations is adopted by Delis and Kouretas (2011).

[27] Regressions are performed using the *xtabond2* command in Stata. The *collapse* option indicates that *xtabond2* should create one instrument for each variable and lag distance instead of one for each time period, variable and lag distance.

[28] Before running my estimates, panel unit-root tests are used to ensure that the continuous variables included in the model are stationary. The results of Fisher-type (Choi, 2001) tests strongly reject the null hypothesis that all panels contain a unit root.

[29] Only the first lag of the dependent variable is considered among the regressors, since the coefficient on the second lag is not found to be statistically significant.

conditions on the riskiness of financial intermediaries are lower for stakeholder banks ($-0.299 + 0.038 = -0.261$, when bank risk taking is measured by *asset risk*). These results offer support for my initial hypothesis, in that the risk-taking behaviours of banks characterised by alternative ownership structures appear to respond differently to variations in the monetary policy stance. With respect to the bank-specific variables, a lower deposits-to-total-liabilities ratio seems to reduce banks' capacity to take on risk, while less profitable but more efficient intermediaries tend to have greater levels of asset risk. In turn, whereas better capitalised banks exhibit higher credit quality, greater diversification across income sources translates into higher credit risk taking. In line with the concentration–stability view (Beck et al., 2006), financial institutions in more concentrated markets tend to have lower incentives to take on risk. Interestingly, this paper finds support for a moral hazard problem induced by explicit deposit insurance, while only the stringency of capital regulations is likely to restrain banks from engaging in greater risk taking. Consistent with other empirical findings (Lee and Hsieh, 2013), financial intermediaries operating in countries with higher rates of GDP growth and inflation hold less risky portfolios. In addition, credit risk is found to be negatively linked to share price volatility and to changes in borrowers' net worth.

As noted in Section 3.3, the last few years covered by the estimations have seen the adoption by many central banks of unprecedented actions aimed at restoring financial stability. For this reason, this study provides an insight into the functioning of the risk-taking channel during times of financial distress by distinguishing between two periods, namely the years before the outbreak of the crisis (i.e. 1999–2007) and the period after the collapse of Lehman Brothers (i.e. 2008–2011).[30] The results for the former period largely resemble those for the whole sample period. Lower

[30]The validity of splitting the sample around 2008 is tested by replacing the vector of time-fixed effects included in the full-period estimates with a dummy variable that equals 1 for the crisis years and 0 otherwise. The coefficient on the dummy is strongly significant, possibly suggesting fundamental differences in the operation of the risk-taking channel between the crisis and non-crisis periods.

Table 3.5 Main Estimations: Stakeholder Banks as a Group

	1999–2011		1999–2007		2008–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged asset risk	0.874***		0.706***		0.553***	
	(0.047)		(0.044)		(0.046)	
Lagged credit risk		0.622***		0.306***		0.417***
		(0.100)		(0.117)		(0.153)
Overnight rate	-0.299***	-0.007***	-0.262***	-0.009***	0.049	-0.002
	(0.062)	(0.002)	(0.062)	(0.004)	(0.047)	(0.002)
Overnight rate × Stakeholder	0.038***	0.002***	0.063***	0.002**	-0.074***	0.001**
	(0.014)	(0.000)	(0.022)	(0.001)	(0.014)	(0.001)
Central bank assets					0.001	0.000
					(0.009)	(0.000)
Central bank assets × Stakeholder					0.017***	-0.001***
					(0.005)	(0.000)
Bank-level controls						
Size	0.008	-0.001	-0.036	-0.001	0.139**	-0.001
	(0.031)	(0.001)	(0.035)	(0.001)	(0.068)	(0.002)
Capitalisation	-0.008	-0.002***	0.007	0.000	-0.022	-0.002***
	(0.008)	(0.000)	(0.011)	(0.000)	(0.013)	(0.001)
Deposits	0.007**	0.000**	0.007	0.000	0.003	0.000**
	(0.003)	(0.000)	(0.004)	(0.000)	(0.003)	(0.000)
Securitisation	0.001	-0.000	0.003	-0.000	0.010	-0.001***
	(0.002)	(0.000)	(0.002)	(0.000)	(0.007)	(0.000)
Profitability	-0.153*	0.001	-0.410***	-0.010***	0.283***	0.008*
	(0.091)	(0.002)	(0.104)	(0.003)	(0.082)	(0.005)
Efficiency	-0.020***	0.000	-0.040***	-0.001***	0.021***	0.000*
	(0.007)	(0.000)	(0.007)	(0.000)	(0.005)	(0.000)
Income diversity	-0.087	0.039***	1.428***	0.031***	-1.819***	0.007
	(0.281)	(0.008)	(0.340)	(0.011)	(0.264)	(0.007)
Industry-specific controls						
Concentration	-0.000***	-0.000***	0.000	-0.000**	0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Activity restrictions	-0.018	0.001	0.028	-0.001*	0.064***	-0.003***
	(0.014)	(0.000)	(0.035)	(0.001)	(0.021)	(0.001)
Capital stringency	0.024	-0.002***	-0.047**	0.001	0.014	-0.000
	(0.015)	(0.000)	(0.022)	(0.001)	(0.033)	(0.001)
Supervisory power	0.007	0.001**	-0.148***	-0.003**	0.020	0.002**
	(0.010)	(0.000)	(0.031)	(0.001)	(0.021)	(0.001)
Deposit insurance	0.058**	0.002**	0.124***	0.001	-0.060	-0.003
	(0.024)	(0.001)	(0.026)	(0.001)	(0.069)	(0.003)
Private monitoring	0.014	0.004***	-0.187***	-0.005**	-0.095*	0.001
	(0.022)	(0.001)	(0.034)	(0.002)	(0.053)	(0.002)
Macroeconomic controls						
Institutions	0.180	-0.002	-0.026	0.004	-1.027***	-0.043***
	(0.163)	(0.005)	(0.164)	(0.003)	(0.326)	(0.015)
GDP growth	-0.043***	-0.000	-0.109***	-0.001**	-0.007	0.000
	(0.007)	(0.000)	(0.015)	(0.001)	(0.008)	(0.000)
Inflation	0.017	-0.001***	-0.012	-0.001*	0.003	0.000

Table 3.5 *(Continued)*

	1999–2011		1999–2007		2008–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
	(0.011)	(0.000)	(0.018)	(0.000)	(0.016)	(0.001)
Volatility	0.001	-0.001***	-0.030***	-0.000*	-0.005	-0.001***
	(0.002)	(0.000)	(0.006)	(0.000)	(0.004)	(0.000)
House prices	0.003	-0.000***	-0.003	-0.000***	0.013***	-0.001***
	(0.002)	(0.000)	(0.003)	(0.000)	(0.003)	(0.000)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	40256	38414	26407	25024	13849	13390
No. of instruments	63	63	59	59	58	58
Wald χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000	0.000	0.000	0.000
$AR(2)$	0.162	0.514	0.240	0.947	0.140	0.994
Hansen χ^2 (p-value)	0.139	0.102	0.239	0.279	0.187	0.190

Notes: The table presents the results of the main empirical estimations with stakeholder banks considered as a group. *Asset risk* is the ratio of risk assets to total assets; *Credit risk* is the ratio of loan loss provisions to total loans; *Overnight rate* is the annual average of the daily overnight interbank rate; *Stakeholder* is a dummy that equals 1 for either cooperative or savings banks and 0 otherwise; *Central bank assets* is the ratio of central bank assets to nominal GDP; *Size* is the natural logarithm of real total assets; *Capitalisation* is the ratio of equity to total assets; *Deposits* is the ratio of deposits to total liabilities; *Securitisation* is the ratio of OBS items to total assets; *Profitability* is the ratio of profit before tax to total assets; *Efficiency* is the ratio of cost to total income; *Income diversity* is a measure of income diversification; *Concentration* is the Herfindahl–Hirschman Index of market concentration; *Activity restrictions* is an index of the extent to which banks can engage in a number of activities; *Capital stringency* is an index of the regulatory oversight of bank capital; *Supervisory power* is an index of the power of the supervisory authority to influence the behaviour on the part of banks; *Deposit insurance* is an index of each country's explicit deposit insurance regime; *Private monitoring* is an index of the degree to which regulatory and supervisory policies affect the private monitoring of banks; *Institutions* is a composite measure of country-level governance; *GDP growth* is the annual growth rate of real GDP; *Inflation* is the annual change in the CPI; *Volatility* is the annual average of the daily historical volatility of the country's stock market index; *House prices* is the annual change in the residential property price index (divided by the GDP deflator). All econometric specifications include country as well as time fixed effects. Robust standard errors (clustered at the bank level) are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

interest rates are associated with an increase in the appetite for risk by shareholder banks, with this effect being stronger when the dependent variable is proxied by *asset risk*. However, the impact of looser monetary policy on intermediaries' risk taking is dampened by the presence of stakeholder banks, as denoted by the positive and highly significant coefficient on the multiplicative term. This evidence is consistent with recent empirical findings (Ferri et al., 2014), according to which the

loan supply of stakeholder banks prior to the start of the crisis was less influenced by changing monetary conditions. Again, this paper finds that banks with lower profitability but greater efficiency have riskier balance sheets, while *capitalisation* and *deposits* are not important in explaining differences in the riskiness of financial institutions. As indicated by other studies (Hesse and Cihák, 2007), the results reported in Table 3.5 suggest that higher income diversity tends to increase bank risk. At the industry level, market concentration is negatively linked to banks' appetite for risk, although this relationship is statistically significant only under the specification that considers *credit risk* as the dependent variable. Regarding the regulatory environment, greater stringency in terms of capital regulations, power of the supervisory authority and market discipline seems to be effective in limiting the risk-taking incentives by banks (particularly when bank risk is captured by *asset risk*), whilst further support is provided for a risk-shifting effect associated with deposit insurance. Moreover, macroeconomic conditions have a bearing on banks' portfolio risk, yet at varying degrees. Whereas *GDP growth* is negatively related to both of the proxies for bank risk taking, the rate of inflation is found to have some influence only on the quality of loan portfolios. Consonant with theoretical predictions (Paligorova and Santos, 2013), lower stock market volatility offers financial firms incentives to take on additional risk. Moreover, the findings for the years before the crisis appear to confirm that a boost in house prices raises the value of borrowers' collateral and improves credit quality.

Turning to the crisis period, one can note several striking results. The coefficient of the *Overnight rate* is insignificant in both specifications, implying that a risk-taking channel is no longer operative for shareholder banks. This is not surprising, as the havoc wrought by the financial turmoil resulted in an average increase in risk aversion and a widespread seizure of liquidity in financial markets (Acharya et al., 2009). Conversely, this study finds that standard monetary policy is still effective in influencing the composition of stakeholder banks' portfolios, although this impact is

lower in absolute value compared to the non-crisis period ($0.049 - 0.074 = -0.025$ for the crisis years compared to $-0.262 + 0.063 = -0.199$ for the pre–crisis years when the dependent variable is *asset risk*). In showing that the appetite for risk by stakeholder banks is more stable over the business cycle relative to their shareholder counterparts, my evidence is in line with the literature that points to a less cyclical behaviour by stakeholder banks (Meriläinen, 2016). To account for the effects of unconventional monetary policy on the functioning of the risk-taking channel, I add to the estimations the ratio of central bank assets to GDP (*central bank assets*) and its interaction with the stakeholder bank dummy. At a first glance, the positive coefficients on these two terms when bank risk is measured by *asset risk* seem to denote an important role played by non-standard measures in counteracting the shift by intermediaries towards riskless assets.[31] Nevertheless, a closer look at the coefficients reveals that the expansion of central bank assets is associated with a change in portfolio composition only for stakeholder banks, suggesting that—at times of financial distress—monetary authorities might exert an impact on the non-financial sector via the risk-taking behaviours of cooperative and savings banks. Non-standard monetary policy is also found to influence credit risk taking only for stakeholder banks, with an increase in central bank assets leading to a decline in loan loss provisioning by cooperative and savings banks.[32] Concerning bank-level controls, one can note that banks of a larger size and with a higher share of deposits to total liabilities exhibit a greater exposure to asset and credit risk, respectively, whereas *capitalisation* and *securitisation* are found to have a negative relationship with *credit risk*. Contrary to the pre–crisis period, the results for the crisis years indicate that more diversified banks are less inclined to take on asset risk. Interest-

[31] Similar evidence of a positive relationship between unconventional monetary policy measures and risk assets is put forward by Lambert and Ueda (2014). Within the context of the bank lending channel, support is also found for a positive impact of central bank assets on loan growth (Fungácová et al., 2014).

[32] The negative coefficient on the interaction between *central bank assets* and *stakeholder* is consistent with Lambert and Ueda (2014), who show that an expansion in central banks' balance sheets may delay loss provisioning on existing loans.

ingly, banks operating in economies characterised by higher degrees of concentration and greater restrictions on banking activities hold more assets with non-negligible credit and market risk on their balance sheets. In turn, the incentives for intermediaries to alter their credit quality are curtailed by more stringent regulations on banking operations and are exacerbated by greater supervisory power. As expected, a reduction in share price volatility and in borrowers' collateral increases credit risk taking by banks, whilst greater institutional development is associated with lower exposure to both asset and credit risk.

Although—as observed in Section 3.2—cooperative and savings banks share the main objective of creating value for a wider array of stakeholders, some important differences exist between these two types of financial intermediaries. While cooperative banks are owned by their members, savings banks belong either to an organisation that is part of the government or to a private foundation. This is particularly the case in countries such as Germany and Switzerland, where savings banks are characterised by multi-level (i.e. municipal or regional) governance structures with an ownership stake held by the government (Ferri et al., 2013). For this reason, it is postulated that differences in risk appetite exist not only between shareholder and stakeholder banks, but also between cooperative and savings banks. To test this prediction, Table 3.6 presents the results of the main empirical estimations after disaggregating stakeholder banks into cooperative and savings banks. Looking at the full period, one may note that the dampening role played by cooperative and savings banks within the risk-taking channel is confirmed by the positive and statistically significant coefficients on both interaction terms. However, the size of the individual coefficients reveals some key differences between the two groups of stakeholder banks, as savings banks are found to take on less asset and credit risk relative to cooperative banks in a looser monetary environment. These findings are mirrored by the results for the pre–crisis period, in which the risk-taking incentives of savings banks appear to be the least affected by relatively low interest rates. During the

years since the outbreak of the crisis, conventional monetary policy seems to be still exerting an impact on the risk decisions of both cooperative and savings banks, with this impact being lower for cooperative banks. In addition, the expansion in central bank assets is linked to a change in the risk exposure of the two types of stakeholder banks to approximately the same extent. Taken together, the results for cooperative and savings banks separately confirm the results for stakeholder banks as a group, in that both cooperative and savings banks are found to conduct less procyclical risk-taking policies relative to their commercial counterparts.

3.4.2 Robustness Tests

To evaluate the robustness of the results, a number of additional tests are performed. As correctly quantifying risk taking by financial intermediaries is a fairly challenging task, I first examine whether the results are sensitive to an alternative way of defining the dependent variable. For this purpose, I consider a measure of bank riskiness that has been used extensively in the literature, namely the *Z-score* (Dong et al., 2014; García-Kuhnert et al., 2015; Mohsni and Otchere, 2014).[33] The *Z-score* is a proxy for distance from insolvency (probability of default) and is computed as follows:

$$Z\text{-}score = \frac{\mu\left(ROA\right) + CAR}{\sigma\left(ROA\right)} \tag{3.4}$$

where ROA is the Return On Assets and CAR is the Capital-to-Asset Ratio. Specifically, a time-varying *Z-score* is constructed following the approach proposed by Lepetit and Strobel (2013), which is found to exhibit a relatively low level of intertemporal volatility on a per bank basis. This approach considers mean and standard deviation estimates of ROA calculated over the full sample and combines them

[33] A discussion of the applicability of the *Z-score* to the estimation of bank risk across different types of intermediaries is offered by Hesse and Cihák (2007).

Table 3.6 Main Estimations: Cooperative and Savings Banks Separately

	1999–2011		1999–2007		2008–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged asset risk	0.875***		0.699***		0.560***	
	(0.047)		(0.045)		(0.043)	
Lagged credit risk		0.656***		0.302***		0.410***
		(0.104)		(0.111)		(0.152)
Overnight rate	-0.297***	-0.008***	-0.268***	-0.008***	0.069	-0.002
	(0.062)	(0.002)	(0.062)	(0.003)	(0.047)	(0.002)
Overnight rate × Cooperative	0.034**	0.002***	0.055**	0.001**	-0.074***	0.001**
	(0.014)	(0.000)	(0.024)	(0.000)	(0.014)	(0.001)
Overnight rate × Savings	0.042***	0.002***	0.074***	0.002***	-0.084***	0.001**
	(0.015)	(0.000)	(0.023)	(0.001)	(0.016)	(0.001)
Central bank assets					0.002	0.000
					(0.008)	(0.000)
Central bank assets × Cooperative					0.018***	-0.001**
					(0.006)	(0.000)
Central bank assets × Savings					0.018***	-0.001***
					(0.004)	(0.000)
Bank-level controls						
Size	0.010	-0.000	-0.043	-0.001	0.149***	-0.000
	(0.030)	(0.001)	(0.035)	(0.001)	(0.057)	(0.001)
Capitalisation	-0.009	-0.002***	0.008	0.000	-0.017	-0.002**
	(0.008)	(0.000)	(0.011)	(0.000)	(0.013)	(0.001)
Deposits	0.007**	0.000***	0.006	0.000	0.003	0.000**
	(0.003)	(0.000)	(0.004)	(0.000)	(0.003)	(0.000)
Securitisation	0.001	-0.000	0.003	0.000	0.008	-0.001***
	(0.002)	(0.000)	(0.002)	(0.000)	(0.007)	(0.000)
Profitability	-0.138	0.002	-0.406***	-0.010***	0.292***	0.008
	(0.089)	(0.002)	(0.103)	(0.002)	(0.085)	(0.005)
Efficiency	-0.019***	0.000	-0.040***	-0.001***	0.021***	0.000*
	(0.006)	(0.000)	(0.007)	(0.000)	(0.005)	(0.000)
Income diversity	-0.136	0.039***	1.479***	0.030***	-1.739***	0.007
	(0.289)	(0.009)	(0.344)	(0.008)	(0.273)	(0.007)
Industry-specific controls						
Concentration	-0.000***	-0.000***	0.000	-0.000**	0.000***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Activity restrictions	-0.018	0.000	0.031	-0.001*	0.056***	-0.003***
	(0.014)	(0.000)	(0.035)	(0.001)	(0.018)	(0.001)
Capital stringency	0.022	-0.002***	-0.048**	0.001	-0.016	-0.000
	(0.014)	(0.000)	(0.022)	(0.001)	(0.032)	(0.001)
Supervisory power	0.008	0.001***	-0.147***	-0.003***	0.036	0.002**
	(0.010)	(0.000)	(0.031)	(0.001)	(0.023)	(0.001)
Deposit insurance	0.057**	0.002**	0.128***	0.001	-0.078	-0.004
	(0.025)	(0.001)	(0.027)	(0.001)	(0.064)	(0.003)
Private monitoring	0.014	0.004***	-0.185***	-0.005***	-0.090**	0.001
	(0.022)	(0.001)	(0.034)	(0.001)	(0.038)	(0.002)
Macroeconomic controls						
Institutions	0.192	-0.001	-0.053	0.004	-1.066***	-0.045***

Table 3.6 *(Continued)*

	1999–2011		1999–2007		2008–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
	(0.163)	(0.004)	(0.168)	(0.002)	(0.338)	(0.015)
GDP growth	-0.042***	-0.000	-0.110***	-0.001***	-0.010	0.000
	(0.007)	(0.000)	(0.015)	(0.000)	(0.008)	(0.000)
Inflation	0.016	-0.001***	-0.012	-0.001***	0.003	0.000
	(0.011)	(0.000)	(0.018)	(0.000)	(0.016)	(0.001)
Volatility	0.001	-0.001***	-0.031***	-0.000**	-0.006	-0.001***
	(0.002)	(0.000)	(0.006)	(0.000)	(0.004)	(0.000)
House prices	0.003	-0.000***	-0.003	-0.000***	0.013***	-0.001***
	(0.002)	(0.000)	(0.003)	(0.000)	(0.003)	(0.000)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	40256	38414	26407	25024	13849	13390
No. of instruments	64	64	60	60	60	60
Wald χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000	0.000	0.000	0.000
$AR(2)$	0.149	0.501	0.252	0.976	0.155	0.989
Hansen χ^2 (p-value)	0.106	0.108	0.271	0.383	0.134	0.158

Notes: The table presents the results of the main empirical estimations with cooperative and savings banks considered separately. *Asset risk* is the ratio of risk assets to total assets; *Credit risk* is the ratio of loan loss provisions to total loans; *Overnight rate* is the annual average of the daily overnight interbank rate; *Cooperative* is a dummy that equals 1 for cooperative banks and 0 otherwise; *Savings* is a dummy that equals 1 for savings banks and 0 otherwise; *Central bank assets* is the ratio of central bank assets to nominal GDP; *Size* is the natural logarithm of real total assets; *Capitalisation* is the ratio of equity to total assets; *Deposits* is the ratio of deposits to total liabilities; *Securitisation* is the ratio of OBS items to total assets; *Profitability* is the ratio of profit before tax to total assets; *Efficiency* is the ratio of cost to total income; *Income diversity* is a measure of income diversification; *Concentration* is the Herfindahl–Hirschman Index of market concentration; *Activity restrictions* is an index of the extent to which banks can engage in a number of activities; *Capital stringency* is an index of the regulatory oversight of bank capital; *Supervisory power* is an index of the power of the supervisory authority to influence the behaviour on the part of banks; *Deposit insurance* is an index of each country's explicit deposit insurance regime; *Private monitoring* is an index of the degree to which regulatory and supervisory policies affect the private monitoring of banks; *Institutions* is a composite measure of country-level governance; *GDP growth* is the annual growth rate of real GDP; *Inflation* is the annual change in the CPI; *Volatility* is the annual average of the daily historical volatility of the country's stock market index; *House prices* is the annual change in the residential property price index (divided by the GDP deflator). All econometric specifications include country as well as time fixed effects. Robust standard errors (clustered at the bank level) are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

with current values of *CAR* (Lepetit and Strobel, 2013).[34] Therefore, the *Z-score* captures the number of standard deviations the bank's *ROA* has to fall before equity is depleted and the bank becomes insolvent. A higher value denotes greater bank

stability (lower risk taking). Since the *Z-score* is highly skewed, this paper follows Laeven and Levine (2009) and employs its natural logarithm.

Table 3.7 presents summary statistics for the alternative measure of bank risk taking as well as its components by dividing the sample according to ownership type. Consistent with other empirical evidence (Ayadi et al., 2009, 2010; Hesse and Cihák, 2007), the average values of the *Z-score* for cooperative and savings banks are higher than for their commercial counterparts, suggesting that stakeholder banks are generally more financially stable than shareholder banks. Furthermore, the relatively low standard deviation of the *Z-score* for stakeholder banks indicates less volatility in their probability of default compared to their shareholder peers, confirming the findings based on the main proxies for bank riskiness. A closer look at the components of the *Z-score* reveals that the greater stability of cooperative and savings banks stems from the lower standard deviation of *ROA* (0.454% and 0.553%, respectively), which is less than half that for commercial banks (1.345%).

Table 3.7 Summary Statistics of the *Z-score* and Its Components by Ownership Structure

	Shareholder		Cooperative		Savings		Stakeholder	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Z-score	2.728	1.056	3.849	0.928	3.884	0.985	3.860	0.947
ROA	0.766	1.345	0.401	0.454	0.377	0.553	0.393	0.489
CAR	12.846	13.404	7.816	4.495	7.707	6.106	7.780	5.084

Notes: The table presents summary statistics for the *Z-score* and its components by dividing the sample according to ownership type. *Shareholder* are commercial banks, while *stakeholder* include cooperative and savings banks. *Z-score* is a proxy for distance to default; *ROA* is the Return On Assets; *CAR* is the Capital-to-Asset Ratio.

Table 3.8 reports the results for the full period as well as for the years before and after the collapse of Lehman Brothers with the *Z-score* as an alternative measure of bank risk taking. The coefficients of the interest rate variables are qualitatively

[34] I also test a definition of the *Z-score* à la Hesse and Cihák (2007), who use standard deviation estimates of *ROA* calculated over the full sample alongside current values of *ROA* and *CAR*. The results of this exercise, not reported to save space but available upon request, are similar to the ones presented in Table 3.8.

similar and, as a result, the findings remain unchanged. Interestingly, while the expansion in central bank balance sheets is associated with an increase in the proportion of assets carrying credit and market risk in stakeholder banks' portfolios, the default probability of cooperative and savings banks appears to be reduced by non-standard monetary interventions.[35]

A second robustness check is to ensure that the results are not driven by the proxy for conventional monetary policy used in the empirical estimations. Although the overnight interbank rate is commonly employed by the literature while studying the risk-taking channel (Jiménez et al., 2014; Maddaloni and Peydró, 2011), standard monetary policy can be measured in a variety of ways. To this end, I enquire into the sensitivity of the results by replacing the overnight rate with the central bank's official rate (*central bank rate*), computed as the annual average of the daily central bank rate. For instance, this rate is the interest rate on the Main Refinancing Operations (MROs) for the euro area, the base rate for the UK and the repo rate for Sweden. The results of this exercise are reported in Table 3.9 and are largely in line with those of the benchmark specifications.[36]

Third, since the group of commercial banks includes intermediaries of a heterogeneous nature, Equation 3.3 is re-estimated after excluding banks that are listed on the stock exchange. As the literature suggests (Bhaumik et al., 2011; Iannotta et al., 2007), market scrutiny is a key determinant of bank behaviour. On average, listed banks tend to be larger, more profitable, better capitalised, with lower asset quality and funded through a higher ratio of retail deposits (Iannotta et al., 2007). A possible explanation for the observed differences between listed and unlisted banks lies in the ability of publicly quoted banks to raise additional equity at lower transaction costs, enabling them to attain faster asset growth and higher

[35]The evidence of a positive relationship between central bank assets and bank stability is in line with Lambert and Ueda (2014), who find that unconventional monetary policy measures are linked to a decrease in some indicators of bank riskiness, namely leverage and short-term debt ratios.

[36]I also experiment with interest rates of longer maturities, namely the one-month and three-month interbank rates. The results, not reported but available upon request, are again confirmed.

Table 3.8 Robustness Test: An Alternative Measure of Bank Risk Taking

Dependent variable:	*Z-score*		
	1999–2011	1999–2007	2008–2011
Lagged Z-score	0.898***	0.644***	0.727***
	(0.026)	(0.092)	(0.075)
Overnight rate	0.082**	0.235**	0.047
	(0.034)	(0.111)	(0.054)
Overnight rate × *Stakeholder*	-0.035***	-0.095***	-0.039**
	(0.009)	(0.035)	(0.019)
Central bank assets			-0.006
			(0.009)
Central bank assets × *Stakeholder*			0.018***
			(0.006)
Bank-level controls	Yes	Yes	Yes
Industry-specific controls	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
No. of observations	40140	26319	13821
No. of instruments	63	59	58
Wald χ^2 (p-value)	0.000	0.000	0.000
$AR(1)$	0.000	0.007	0.006
$AR(2)$	0.976	0.242	0.341
Hansen χ^2 (p-value)	0.119	0.312	0.291

Notes: The table reports the results of the empirical estimations with the *Z-score* as an alternative measure of bank risk taking. *Z-score* is a proxy for distance to default; *Overnight rate* is the annual average of the daily overnight interbank rate; *Stakeholder* is a dummy that equals 1 for either cooperative or savings banks and 0 otherwise; *Central bank assets* is the ratio of central bank assets to nominal GDP. Coefficients on the control variables are not reported to save space. All econometric specifications include country as well as time fixed effects. Robust standard errors (clustered at the bank level) are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 3.9 Robustness Test: An Alternative Measure of Monetary Policy

	1999–2011		1999–2007		2008–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged asset risk	0.833***		0.703***		0.586***	
	(0.047)		(0.045)		(0.042)	
Lagged credit risk		0.439***		0.314***		0.453**
		(0.145)		(0.108)		(0.183)
Central bank rate	-0.279***	-0.009***	-0.256***	-0.009***	0.049	-0.003
	(0.108)	(0.002)	(0.062)	(0.003)	(0.069)	(0.003)
Central bank rate × *Stakeholder*	0.048***	0.002***	0.059***	0.002***	-0.111***	0.001**
	(0.018)	(0.000)	(0.022)	(0.001)	(0.017)	(0.001)
Central bank assets					-0.010	0.000
					(0.011)	(0.000)
Central bank assets × *Stakeholder*					0.025***	-0.001***
					(0.006)	(0.000)
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	40256	38414	26407	25024	13849	13390
No. of instruments	63	63	59	59	58	58
Wald χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000	0.000	0.000	0.000
$AR(2)$	0.188	0.316	0.273	0.734	0.318	0.900
Hansen χ^2 (p-value)	0.100	0.149	0.207	0.154	0.229	0.118

Notes: The table reports the results of the empirical estimations with the central bank's official rate as an alternative measure of monetary policy. *Asset risk* is the ratio of risk assets to total assets; *Credit risk* is the ratio of loan loss provisions to total loans; *Central bank rate* is the annual average of the daily central bank rate; *Stakeholder* is a dummy that equals 1 for either cooperative or savings banks and 0 otherwise; *Central bank assets* is the ratio of central bank assets to nominal GDP. Coefficients on the control variables are not reported to save space. All econometric specifications include country as well as time fixed effects. Robust standard errors (clustered at the bank level) are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

risk-adjusted return relative to privately owned banks (Barry et al., 2011). In turn, this could provide listed banks with greater flexibility to engage in riskier projects that carry higher expected profits (Barry et al., 2011). Therefore, a major concern is that the ownership dummy might also capture the effects of market discipline on bank risk taking, possibly leading to an overestimation of the role played by ownership structure in the risk-taking channel of monetary transmission. To investigate

whether differences in risk appetite between shareholder and stakeholder banks hold among unlisted institutions, Table 3.10 presents the results of the empirical estimations when listed banks are dropped from the dataset.[37] The point estimates for the variables of interest are close to those reported in Table 3.5, implying that the main results are not driven by listed banks.

A further concern relates to the inclusion among shareholder banks of financial intermediaries that are ultimately owned by the government or another public authority. The number of state-owned commercial banks increased sharply during the last years of the sample period, as many European banks required extensive government support following the outbreak of the global financial crisis. Cases in point are the Royal Bank of Scotland in the UK, ABN AMRO in the Netherlands and Allied Irish Banks in Ireland, which are still under the control of their governments. According to the literature (Shleifer and Vishny, 1997), bureaucrats—who have the de facto control of state firms—generally pursue goals that are dictated by their political interests rather than the generation of profits. For this reason, one may expect shareholder wealth maximisation not to be the ultimate objective of this type of intermediaries. Consistent with this argument, recent empirical evidence for Western European countries shows that government ownership indeed alters the risk-taking incentives of commercial banks (Iannotta et al., 2013). Therefore, the baseline equation is re-run on a reduced sample that excludes state-owned commercial banks. The results, presented in Table 3.11, remain substantially unaffected.

Lastly, one may observe that the sample is largely dominated by German banks. In terms of number of individual institutions, shareholder and stakeholder banks from Germany constitute 42.06% of the total of financial intermediaries from the selected countries, with German cooperative and savings banks alone making up 52.81% of stakeholder banks included in the sample. A similar picture can be seen with respect to total assets, as the German stakeholder banking sector is found to

[37] Specifically, I exclude banks that have been listed on the stock exchange for at least one year over the 1999–2011 period.

Table 3.10 Robustness Test: Exclusion of Listed Banks

	1999–2011		1999–2007		2008–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged asset risk	0.882***		0.737***		0.545***	
	(0.041)		(0.049)		(0.045)	
Lagged credit risk		0.546***		0.274**		0.358**
		(0.095)		(0.109)		(0.167)
Overnight rate	-0.337***	-0.007**	-0.309***	-0.007***	0.033	-0.003
	(0.063)	(0.003)	(0.081)	(0.003)	(0.050)	(0.002)
Overnight rate × *Stakeholder*	0.041***	0.002***	0.055**	0.001***	-0.081***	0.002***
	(0.015)	(0.000)	(0.028)	(0.000)	(0.017)	(0.001)
Central bank assets					-0.003	0.000
					(0.009)	(0.000)
Central bank assets × *Stakeholder*					0.016***	-0.001**
					(0.005)	(0.000)
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	38003	36236	24823	23494	13180	12742
No. of instruments	63	63	59	59	58	58
Wald χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000	0.000	0.000	0.000
$AR(2)$	0.106	0.594	0.107	0.830	0.128	0.710
Hansen χ^2 (p-value)	0.135	0.227	0.241	0.232	0.125	0.106

Notes: The table reports the results of the empirical estimations after excluding listed banks from the sample. *Asset risk* is the ratio of risk assets to total assets; *Credit risk* is the ratio of loan loss provisions to total loans; *Overnight rate* is the annual average of the daily overnight interbank rate; *Stakeholder* is a dummy that equals 1 for either cooperative or savings banks and 0 otherwise; *Central bank assets* is the ratio of central bank assets to nominal GDP. Coefficients on the control variables are not reported to save space. All econometric specifications include country as well as time fixed effects. Robust standard errors (clustered at the bank level) are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

Table 3.11 Robustness Test: Exclusion of State-Owned Commercial Banks

	1999–2011		1999–2007		2008–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged asset risk	0.853***		0.717***		0.548***	
	(0.051)		(0.044)		(0.042)	
Lagged credit risk		0.620***		0.277**		0.315***
		(0.120)		(0.115)		(0.121)
Overnight rate	-0.327***	-0.007***	-0.265***	-0.008**	-0.005	-0.002
	(0.076)	(0.002)	(0.063)	(0.003)	(0.047)	(0.001)
Overnight rate × *Stakeholder*	0.057***	0.002***	0.058***	0.001**	-0.073***	0.001**
	(0.015)	(0.000)	(0.022)	(0.001)	(0.014)	(0.001)
Central bank assets					-0.008	0.000
					(0.009)	(0.000)
Central bank assets × *Stakeholder*					0.022***	-0.001***
					(0.005)	(0.000)
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	39708	37934	26062	24725	13646	13209
No. of instruments	63	63	59	59	58	58
Wald χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000	0.000	0.000	0.000
$AR(2)$	0.145	0.812	0.118	0.872	0.198	0.557
Hansen χ^2 (p-value)	0.236	0.461	0.175	0.104	0.152	0.110

Notes: The table reports the results of the empirical estimations after excluding state-owned commercial banks from the sample. *Asset risk* is the ratio of risk assets to total assets; *Credit risk* is the ratio of loan loss provisions to total loans; *Overnight rate* is the annual average of the daily overnight interbank rate; *Stakeholder* is a dummy that equals 1 for either cooperative or savings banks and 0 otherwise; *Central bank assets* is the ratio of central bank assets to nominal GDP. Coefficients on the control variables are not reported to save space. All econometric specifications include country as well as time fixed effects. Robust standard errors (clustered at the bank level) are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

cover 44.56% of the sum of total assets for cooperative and savings banks in Western Europe. It follows that the baseline results might reflect peculiarities of the German banking sector, possibly biasing my conclusions. As a fifth robustness check, I thus test whether the results hold when German banks are dropped from the sample. The results of this additional exercise are reported in Table 3.12. The main finding that stakeholder banks play a dampening role in the risk-taking channel is again

Table 3.12 Robustness Test: Exclusion of German Banks

	1999–2011		1999–2007		2008–2011	
	(1)	(2)	(3)	(4)	(5)	(6)
Lagged asset risk	0.873***		0.727***		0.604***	
	(0.054)		(0.048)		(0.039)	
Lagged credit risk		0.488***		0.440***		0.548***
		(0.092)		(0.168)		(0.089)
Overnight rate	-0.303***	-0.003***	-0.289***	-0.004***	0.040	-0.001
	(0.089)	(0.001)	(0.076)	(0.001)	(0.059)	(0.001)
Overnight rate × *Stakeholder*	0.043**	0.001**	0.054**	0.001***	-0.051***	-0.001**
	(0.019)	(0.000)	(0.022)	(0.000)	(0.017)	(0.000)
Central bank assets					-0.011	0.000
					(0.007)	(0.000)
Central bank assets × *Stakeholder*					0.023***	-0.000***
					(0.006)	(0.000)
Bank-level controls	Yes	Yes	Yes	Yes	Yes	Yes
Industry-specific controls	Yes	Yes	Yes	Yes	Yes	Yes
Macroeconomic controls	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of observations	22187	20561	14666	13455	7521	7106
No. of instruments	62	62	58	58	57	57
Wald χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000	0.000	0.000	0.000
$AR(2)$	0.521	0.116	0.379	0.130	0.461	0.375
Hansen χ^2 (p-value)	0.129	0.115	0.294	0.356	0.214	0.108

Notes: The table reports the results of the empirical estimations after excluding German banks from the sample. *Asset risk* is the ratio of risk assets to total assets; *Credit risk* is the ratio of loan loss provisions to total loans; *Overnight rate* is the annual average of the daily overnight interbank rate; *Stakeholder* is a dummy that equals 1 for either cooperative or savings banks and 0 otherwise; *Central bank assets* is the ratio of central bank assets to nominal GDP. Coefficients on the control variables are not reported to save space. All econometric specifications include country as well as time fixed effects. Robust standard errors (clustered at the bank level) are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% levels, respectively.

supported.[38]

[38] As stakeholder banks are on average smaller than shareholder banks (Table 3.3), I also control for possible differential effects of monetary policy on bank risk taking due to bank size by adding an interaction term between monetary policy and *size* to the benchmark equation. The coefficient on the interaction term turns out to be positive but insignificant in most regressions, leaving the results qualitatively unchanged. In addition, Equation 3.3 is re-estimated after excluding cooperative banks' central institutions, since they are characterised by different business models compared to other banks within their respective networks. The results are not materially different when this smaller sample of intermediaries is considered. Finally, the results are robust to more demanding specifications that include the ratio of fixed assets to total assets as a proxy for franchise value, the percentage of firms listed on the country's stock exchange that either merged with or

3.4.3 Discussion

The major lesson from the empirical analysis is that bank ownership indeed affects the transmission of monetary policy via the risk-taking channel. The evidence that stakeholder banks alter the composition of their portfolios less procyclically than shareholder banks suggests that they might play a useful role in stabilising the aggregate level of risk in the economy. In a nutshell, this finding highlights the systemic benefits to be derived from a critical mass of banks that strive to create value for an array of stakeholders rather than almost solely for their shareholders. A case in point are the results for the crisis period, which show that stakeholder banks may continue to act as conduits of monetary transmission even at times of adverse economic conditions. This notwithstanding, my argument is by no means that the stakeholder banking model should be viewed as a superior alternative to its shareholder counterpart. In fact, there have been instances during the recent crisis where stakeholder banks engaged in similar risky lines of business as large shareholder banks, thereby falling into trouble and suffering relatively high losses.[39] Instead, it is the presence of financial intermediaries characterised by a plurality of ownership structures that might be conducive to financial stability. By virtue of their underlying differences in risk appetite and portfolio structure, the existence of cooperative and savings banks vis-à-vis commercial banks could contribute to lowering systemic risk. As Ayadi et al. (2010, p. 149) effectively put it, "[t]he issue of having a financial system populated by a diversity of organisational forms is as significant as the merits and drawbacks of each particular form of organization".

The results feed into an intense academic and policy debate over the causes of the global financial crisis. The primary implication of this paper is that monetary policy is not neutral from a financial stability perspective. For this reason, my evidence

were acquired by other firms as an indicator of M&A activity and the ratio of government balance to GDP as a measure of fiscal policy.

[39] One of the main examples is represented by the heavy losses in trading incurred by the Dutch cooperative group Rabobank.

concurs with the increasing role of monetary authorities on macroprudential regulation and supervision, as epitomised by the creation—under the responsibility of the European Central Bank (ECB)—of the European Systemic Risk Board (ESRB) in late 2010. In addition, this study finds that heterogeneity of ownership types in the European banking sector is important in explaining the effects of monetary policy on bank risk taking. Therefore, the findings call for the inclusion of measures capturing the diversity of the banking system into the central bank's reaction function, as this is shown to influence the functioning of the risk-taking channel. Most importantly, this research indicates that attempts to regulate the European banking sector should not impair the biodiversity of its ownership structures. The evidence on the contribution of a mixed banking system to financial stability suggests that not only is such a system worth preserving, but it should be promoted through the adoption of effective regulations. It seems vital for policymakers to ensure that the specific features of stakeholder banks are not hindered by regulatory constraints aimed at and devised for shareholder banks.

By providing novel insights into how bank ownership interacts with monetary policy in shaping banks' appetite for risk, this paper sparks a number of new questions. First, future research could move the analysis one step further and explore what specific features of stakeholder banks help explain their different reactions to changing monetary conditions relative to shareholder banks. For instance, it would be interesting to shed light on the extent to which observed differences between these two groups of banks stem from characteristics such as the geographical scope of operation, the orientation towards relationship lending and the potential importance associated with belonging to a network of similar institutions. Second, efforts could be directed at examining the impact that conversion of cooperative banks to joint stock companies has on their risk appetite and ensuing responses to fluctuations in the monetary policy stance. Bearing this in mind, researchers could consider a smaller sample of depository institutions than the one built in this study and con-

struct time-varying proxies for bank ownership. Third, more research is needed on the functioning of the risk-taking channel during the global financial crisis and the eurozone sovereign debt crisis. To this end, the results of this study could be complemented if the sample period were expanded to capture the effects of unconventional monetary interventions more fully and by employing more effective indicators of the monetary policy stance at the zero lower bound, such as the 'shadow rate' suggested by Wu and Xia (2016). Fourth, a fruitful line of enquiry could be to extend the results of this article by looking at how the interactions between banks with different types of ownership affect the risk-taking channel. As such, one could compute indices of ownership diversity based on the relative market shares of shareholder banks vis-à-vis their stakeholder counterparts and test whether diversity in banking buffers the impact of monetary policy on bank risk.

3.5 Conclusions

Recent years have witnessed a revived interest in the far-reaching effects of bank risk taking on financial stability and economic performance. This paper adds to a rapidly evolving line of research that contributes to a better understanding of how financial intermediaries' appetite for risk is influenced by the monetary conditions prevailing in the economy. Theory suggests that a key determinant of firms' risk taking is their ownership structure, which ultimately affects the extent to which multiple stakeholder claims find recognition alongside those made by shareholders. By constructing an unbalanced panel of commercial, cooperative and savings banks operating in 17 Western European countries over the 1999–2011 period, this study finds robust evidence that heterogeneity in ownership types accounts for a differential impact of monetary policy on intermediaries' risk taking. While this impact appears to be particularly strong for shareholder banks, the results indicate that the effects of lower interest rates on systemic risk are dampened by the presence of stakeholder banks. Comparison of the results before and after the onset of the global financial

crisis shows that these findings are driven by the years prior to the collapse of Lehman Brothers, during which commercial banks are found to alter the composition of their portfolios towards riskier structures more actively than cooperative and savings banks. The findings for the period since the outbreak of the crisis highlight that standard monetary policy is no more effective in changing the proportion of risk-related assets held by shareholder banks, possibly as a consequence of the sharp increase in risk aversion and the average loss of trust in counterparties brought about by the global market turmoil. Conversely, the observed reaction of stakeholder banks to the unprecedented set of conventional and unconventional monetary policy measures suggests their important role as vehicles for monetary transmission even at times of financial distress, while pointing to less procyclical risk-taking policies on the part of cooperative and savings banks relative to their commercial peers.

Taken together, the results of this study suggest that ignoring differences in ownership type leads to partial and possibly inaccurate conclusions about the implications of monetary policy for bank risk taking. Therefore, I would hope to see more research examining how various features of intermediaries' ownership structures (e.g. nature of the ultimate owner, concentrated ownership and executive compensation) influence the functioning of the risk-taking channel. At the same time, the findings emphasise that it might be systemically beneficial to have a banking sector populated by a critical mass of stakeholder banks vis-à-vis shareholder banks. For this reason, my hope is that the contribution advanced in this paper will help draw greater attention to the benefits that a biodiverse banking sector might have for the stability of the financial system and its resilience to crises. To use the words of the American biologist Edward O. Wilson on biodiversity, "[w]e study and save it to our great benefit. We ignore and degrade it to our great peril".

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Appendix B

Table B.1 Variable Definitions and Sources

Variable	Definition	Source
Bank risk taking		
Asset risk	Ratio of risk assets to total assets. Risk assets are calculated as the difference between total assets and the sum of loans and advances to banks, government securities and cash.	Bankscope; author's calculations
Credit risk	Ratio of loan loss provisions to total loans. Loans are defined as residential mortgage loans, other mortgage loans, other consumer loans, corporate and commercial loans and other loans minus reserves for loan losses.	Bankscope; author's calculations
Z-score	$\ln\left[\frac{\mu(ROA)+CAR}{\sigma(ROA)}\right]$.	Bankscope; author's calculations
Monetary policy		
Overnight rate	Annual average of the daily overnight interbank rate.	Datastream; national data; author's calculations
Central bank rate	Annual average of the daily central bank rate.	Datastream; IFS; author's calculations
Central bank assets	Ratio of central bank assets to nominal GDP. For the Norges Bank, central bank assets are computed as the difference between total assets and investments in the *Government Pension Fund Global*.	National data; IFS; author's calculations
Ownership structure		
Stakeholder	Dummy that equals 1 for either cooperative or savings banks and 0 otherwise.	Bankscope; author's calculations
Cooperative	Dummy that equals 1 for cooperative banks and 0 otherwise.	Bankscope; author's calculations
Savings	Dummy that equals 1 for savings banks and 0 otherwise.	Bankscope; author's calculations
Bank-level controls		
Size	Natural logarithm of total assets (divided by the GDP deflator).	Bankscope; WDI; author's calculations
Capitalisation	Ratio of equity to total assets.	Bankscope; author's calculations
Deposits	Ratio of deposits to total liabilities. Deposits include total customer deposits, deposits from banks as well as other deposits and short-term borrowings.	Bankscope; author's calculations
Securitisation	Ratio of OBS items to total assets.	Bankscope; author's calculations
Profitability	Ratio of profit before tax to total assets.	Bankscope; author's calculations

Table B.1 *(Continued)*

Variable	Definition	Source
Efficiency	Ratio of overheads to total operating income.	Bankscope; author's calculations
Income diversity	$1 - \left\lvert \frac{Net\ interest\ income - Other\ operating\ income}{Total\ operating\ income} \right\rvert$.	Bankscope; author's calculations
Industry-specific controls		
Concentration	Herfindahl–Hirschman Index of market concentration. The index is calculated as the sum of squared market shares of all banks in the country in terms of total assets.	Bankscope; author's calculations
Activity restrictions	Index that captures the extent to which national regulations restrict banks from engaging in: (1) securities activities; (2) insurance activities; (3) real estate activities; and (4) ownership of non-financial firms. Regulatory restrictiveness for each of these activities takes values between 1 and 4, depending on whether they are *unrestricted*, *permitted*, *restricted* or *prohibited*. An aggregate index is computed by summing the values for the four categories.	BRSS; Barth et al. (2001, 2004, 2006, 2012); author's calculations
Capital stringency	Index that measures the stringency of regulatory capital requirements. It is constructed by adding 1 if the answer to questions 1–7 is 'yes' and 0 otherwise, while the opposite holds for questions 8 and 9 (i.e. 'yes' = 0; 'no' = 1): (1) Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities? (2) Is this ratio risk weighted in line with the Basel guidelines? (3) Does the minimum ratio vary as a function of an individual bank's credit risk? (4) Does the minimum ratio vary as a function of market risk? (5–7) Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital? (a) Market value of loan losses not realised in accounting books? (b) Unrealised losses in securities portfolios? (c) Unrealised foreign exchange losses? (8) Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities? (9) Can initial disbursement of capital be done with borrowed funds?	BRSS; Barth et al. (2001, 2004, 2006, 2012); author's calculations

Table B.1 *(Continued)*

Variable	Definition	Source
Supervisory power	Index that proxies for the power of the supervisory authority to influence the behaviour on the part of banks. It is obtained by adding 1 if the answer to each of the following questions is 'yes' and 0 otherwise: (1) Does the supervisory agency have the right to meet with external auditors to discuss their report without the approval of the bank? (2) Are auditors required by law to communicate directly to the supervisory agency any presumed involvement of bank directors or senior managers in illicit activities, fraud or insider abuse? (3) Can supervisors take legal action against external auditors for negligence? (4) Can the supervisory authority force a bank to change its internal organisational structure? (5) Are OBS items disclosed to supervisors? (6) Can the supervisory agency order the bank's directors or management to constitute provisions to cover actual or potential losses? (7–9) Can the supervisory agency suspend the directors' decision to distribute: (a) Dividends? (b) Bonuses? (c) Management fees? (10) Can the bank supervisor legally declare—such that this declaration supersedes some of the rights of shareholders—that a bank is insolvent? (11) According to the Banking Law, has the bank supervisor authority to intervene—that is, suspend some or all ownership rights—a problem bank? (12–14) Regarding bank restructuring and reorganisation, can the supervisory agency do the following: (a) Supersede shareholder rights? (b) Remove and replace management? (c) Remove and replace directors?	BRSS; Barth et al. (2001, 2004, 2006, 2012); author's calculations

Table B.1 *(Continued)*

Variable	Definition	Source
Deposit insurance	Index that describes the explicit deposit insurance regime adopted in the country. It is determined by adding 1 if the answer to each of the following questions is 'yes' and 0 otherwise: (1) Is the explicit deposit insurance protection system funded by the banks? (2) Does the deposit insurance authority make the decision to intervene a bank? (3) Does the deposit insurance authority by itself have the legal power to cancel or revoke deposit insurance for any participating bank? (4) Can the deposit insurance agency/fund take legal action for violations against laws, regulations and bylaws (of the deposit insurance agency) against bank directors or other bank officials? (5) Has the deposit insurance agency/fund ever taken legal action for violations against laws, regulations and bylaws (of the deposit insurance agency) against bank directors or other bank officials?	BRSS; Barth et al. (2001, 2004, 2006, 2012); author's calculations
Private monitoring	Index that quantifies the incentives for private investors to monitor and exert effective governance over banks. It is constructed by adding 1 if the answer to questions 1–9 is 'yes' and 0 otherwise, while the reverse occurs for questions 10 and 11 (i.e. 'yes' = 0; 'no' = 1): (1) Is subordinated debt allowable (required) as part of regulatory capital? (2) Is an external audit a compulsory obligation for banks? (3) Are auditors licensed or certified? (4) Does accrued, though unpaid, interest/principal enter the income statement while the loan is still performing? (5) Does accrued, though unpaid, interest/principal enter the income statement while the loan is still non-performing? (6) Are financial institutions required to produce consolidated accounts covering all bank and any non-bank financial subsidiaries (including affiliates of common holding companies)? (7) Are OBS items disclosed to the public? (8) Must banks disclose their risk management procedures to the public? (9) Are bank directors legally liable if information disclosed is erroneous or misleading? (10) Is there an explicit deposit insurance protection system? (11) Were insured depositors wholly compensated (to the extent of legal protection) the last time a bank failed?	BRSS; Barth et al. (2001, 2004, 2006, 2012); author's calculations

Table B.1 *(Continued)*

Variable	Definition	Source
Macroeconomic controls		
Institutions	Simple average of six country-level governance indicators, namely 'voice and accountability', 'political stability and absence of violence', 'government effectiveness', 'regulatory quality', 'rule of law' and 'control of corruption'.	WGI; Kaufmann et al. (2010); author's calculations
GDP growth	Annual growth rate of real GDP.	WDI
Inflation	Annual change in the CPI.	WDI
Volatility	Annual average of the daily historical volatility of the country's stock market index with a 30-day window.	Bloomberg; author's calculations
House prices	Annual change in the residential property price index (divided by the GDP deflator).	BIS; ECB; WDI; author's calculations

Chapter 4

The Role of Ownership Diversity with Respect to the Risk-Taking Channel of Monetary Transmission

Abstract

This study investigates the hypothesis that the ownership composition of the banking system moderates monetary policy transmission via the risk-taking channel. Borrowing measures used in ecology to quantify diversity, this paper shows that the impact of unexpected monetary policy shocks on banks' probability of default is reduced in countries with greater ownership diversity. This article also finds that banks located in more ownership-diverse systems tend to have a lower appetite for risk than those operating in less diverse markets. These results are robust across several econometric specifications and emphasise the stabilising role played by ownership diversity in modern financial systems.

Keywords: Ecology; financial crisis; financial stability; monetary policy; ownership diversity; risk-taking channel.

4.1 Introduction

The financial crisis that erupted in 2007 has provided a vivid illustration of the potential for modern financial systems to exacerbate and spread financial distress on an international scale (Arinaminpathy et al., 2012). In the wake of the crisis, there is increasing recognition that the resilience of the financial system is affected not only by its aggregate exposure to risk, but also by the interconnections between individual institutions (Haldane and May, 2011). A case in point was the bankruptcy of Lehman Brothers in the third quarter of 2008, which led to an unprecedented seizure of liquidity by financial intermediaries and the ensuing collapse of the interbank lending market. As a result, these events have prompted renewed interest in addressing risk at the systemic level (Berry et al., 2015), while pointing to the important role of banks in the economy (Werner, 2014a,b). A number of studies have recently focused on the implications of diversity within the banking sector for the stability of the financial system and its resilience to crises (e.g. Ayadi et al., 2009; Llewellyn, 2012; Michie, 2011). In making an interesting parallel between 'financial ecosystems' and ecology in the 1970s, Haldane and May (2011, p. 353) argue that "excessive homogeneity within a financial system—all the banks doing the same thing—can minimize risk for each individual bank, but maximize the probability of the entire system collapsing". Consistent with the ecology literature (Tilman and Downing, 1994), this view predicts that diversity with respect to ownership structures, business models and corporate objectives should encourage resistance to disturbance (Michie, 2011).

Despite the increasing appreciation of the need for a systemic approach to financial stability (May and Arinaminpathy, 2010), limited have hitherto been the attempts to examine how the interactions between banks with different forms of ownership impact on financial stability. This is at odds with insights from ecology, where the nature and intensity of the interacting relations (e.g. competition, predation and symbiosis) between individuals belonging to different species are known

to have important effects on ecosystem stability (Jizhong et al., 1991). Therefore, recent calls have been made for a better understanding of the externalities that may stem from financial institutions' behaviour (Groeneveld, 2012). Moreover, hardly any studies have examined how ownership composition of the banking system interacts with monetary policy in shaping financial intermediaries' risk taking. Such a void is surprising, as recent evidence indicates that ownership type has a bearing on monetary transmission via the risk appetite of banks (Drakos et al., 2016). This gap might also have significant consequences from a policy perspective, insofar as monetary intervention may have heterogeneous effects on bank stability, depending on the architecture of the financial system (Boot and Thakor, 1997). A key example is the euro area, where dissimilarities in terms of ownership diversity across countries might account for a differential impact of the common monetary policy on bank behaviour.

Against this background, the aim of this paper is to shed new light on the link between diversity in banking and financial system stability. The question that is addressed concerns the extent to which ownership diversity in the banking sector moderates monetary policy transmission through the risk-taking channel (Borio and Zhu, 2012; Ioannidou et al., 2015; Jiménez et al., 2014). There are at least three theoretical arguments that may give ownership diversity a central role in the transmission of monetary policy to bank risk. First, banks located in countries with more diverse banking systems are likely to be in competition for providing better customer service instead of generating return on equity (Berry et al., 2015). As the competition between banks tends to be directed at serving customers and not at engaging in unduly risky activities, one would expect greater ownership diversity to translate into lower incentives for banks to take on risk in response to changes in monetary policy. Second, enhanced competition arising from a higher degree of diversity in the banking sector should reflect greater disciplining efforts on the part of customers and/or depositors (Kick and Prieto, 2015). To the extent that an

increase in market discipline restricts banks from engaging in riskier projects, monetary policy will induce lower incentives for financial intermediaries to adopt risky balance sheets. Third, the literature suggests that—above a specific market-share threshold—the presence of non-profit-maximising banks has a positive impact on the stability of other banks within the same system (Chiaramonte et al., 2015). It follows that—ceteris paribus—financial intermediaries operating in countries with a multiplicity of ownership forms are likely to be more stable than their counterparts operating in less diverse markets, thereby reducing the potency of the risk-taking channel.

This paper contributes to the literature in several ways. Drawing on the field of ecology, where the interactions between components of an ecosystem are seen as a major determinant of its stability and persistence (Jizhong et al., 1991), it offers novel insights into the implications of ownership diversity for financial stability. By estimating the ownership composition of the banking system in terms of relative market shares of profit-maximising banks (i.e. 'shareholder banks') alongside not-for-profit banks (i.e. 'stakeholder banks'), this study adds to the literature that focuses on the bank ownership–financial stability nexus (e.g. Chiaramonte et al., 2015; Hesse and Cihák, 2007). Furthermore, this article proposes ownership diversity as an important factor explaining differential effects of monetary policy on bank riskiness. While joining the growing debate over the moderating impact that structural features of the market have on the monetary transmission mechanism (e.g. Olivero et al., 2011b), my contribution extends the somewhat limited literature on the role of industry-related factors in determining the functioning of the risk-taking channel (e.g. Kick and Prieto, 2015). In addition, this paper builds on the work by Michie and Oughton (2013) and introduces measures commonly used in ecology to quantify diversity into the analysis of the risk-taking channel. Given the relative ease with which indicators of ownership diversity can be computed, these measures could be employed by future research concerned with the implications of diversity

in banking for a variety of financial and economic phenomena. Importantly, this approach allows to respond to recent calls "for a new, interdisciplinary research agenda on the role of banks and the central bank in particular, and the monetary system in general, which should be firmly rooted in the inductive, empirical research methodology to produce scientific economics" (Werner, 2016, p. 377).

The remainder of the manuscript is structured as follows. Section 4.2 provides an overview of the literature on the risk-taking channel and develops the main hypotheses. Section 4.3 illustrates the data used in the analysis and describes the empirical strategy. Section 4.4 presents the results from the main estimations as well as from further robustness tests. Section 4.5 discusses the implications of the findings and concludes.

4.2 Related Literature and Hypothesis Development

4.2.1 Risk-Taking Channel of Monetary Transmission

In the aftermath of the global financial crisis, a growing debate has ensued on whether risk-taking incentives at financial institutions are shaped by the monetary conditions prevailing in the economy. As the literature suggests (Angeloni et al., 2015; Borio and Zhu, 2012), monetary policy might affect bank risk via two primary channels. The first mechanism operates through changes in the composition of the asset side of intermediaries' balance sheets. According to Cociuba et al. (2016), a prolonged period of low interest rates induces banks to search for yield by making riskier assets more attractive than safe bonds. As financial intermediaries alter the structure of their investments towards a riskier mix, a higher degree of procyclical risk taking is introduced into the financial system (Rajan, 2006) and an equilibrium with weakened bank portfolios is realised (Dell'Ariccia and Marquez, 2006). The second channel refers to the impact of monetary policy on the intermediaries' funding

side. Inasmuch as an expansionary monetary environment reduces marginal funding costs, banks find more profitable to adjust the combination of capital and short-term funding by increasing leverage (Valencia, 2014). However, theory predicts that the effects of interest rates on leverage depend on the extent to which banks can change their capital structures (Dell'Ariccia et al., 2014) and the yield curve is upward sloping (Angeloni et al., 2015).

The theoretical inferences about the risk-taking channel seem to find support in the empirical literature. Drawing on a micro-level dataset for Spain, Jiménez et al. (2014) show that lower overnight rates lead less capitalised banks to grant more credit and higher loan volumes with fewer collateral requirements to ex ante risky borrowers. Similarly, Ioannidou et al. (2015) access the Bolivian credit register and provide evidence for a decrease in policy rates raising the probability of default on individual bank loans, while the additional risk taken by financial intermediaries does not appear to be reflected in greater loan spreads. Findings from the US indicate that the risk ratings of banks' loan portfolios are negatively linked to changes in short-term rates (Dell'Ariccia et al., 2013), although the transmission of monetary policy to bank risk is found to be particularly significant on the funding side (Angeloni et al., 2015). Moreover, empirical evidence for the euro area suggests that the effects of monetary policy on lending standards are more pronounced if interest rates are kept low for an extended period (Maddaloni and Peydró, 2011). Interestingly, support is found for interest rates, together with long-term liquidity provision by the European Central Bank (ECB), leading to a softening in lending standards even after the onset of the recent crisis (Maddaloni and Peydró, 2013).

A number of factors have been put forward by the literature to explain the strength of the risk-taking channel. By constructing a sample of commercial, savings and cooperative banks in 16 eurozone countries, Delis and Kouretas (2011) submit that the effects of loose monetary conditions on risk assets are reduced for banks with higher equity capital and lower Off-Balance-Sheet (OBS) items. According to

Brissimis et al. (2014), both US and European banks endowed with some degree of market power are able to buffer the negative effects of changes in monetary policy on credit risk, while other characteristics such as bank liquidity and capitalisation seem to be less important for the potency of the risk-taking channel. Likewise, Kick and Prieto (2015) focus on German universal banks and show that greater levels of market power (as proxied for by the Lerner index) diminish the impact of monetary policy on bank risk. In addition, there is evidence that the strength of the risk-taking channel is dampened by stricter prudential policy on either bank capital or Loan-To-Value (LTV) ratio (Maddaloni and Peydró, 2011, 2013).

4.2.2 Ownership Diversity and the Risk-Taking Channel

Recent years have witnessed renewed interest in the ownership form of banks and its consequences for financial intermediation (Cull and Martínez Pería, 2013). A major reason behind the increased interest in bank ownership is the observation that co-operative and savings banks have been less scathed by the global financial turmoil relative to commercial banks (Groeneveld, 2011). The key feature of cooperative and savings banks is that they seek to generate value for a wider set of stakeholders and not merely for shareholders. As a result, they are not exclusively profit-oriented institutions and pursue a 'double bottom line', that is, a dual financial and social mission to benefit the community in which they operate (Ayadi et al., 2009, 2010). While cooperative banks are owned by their members, savings banks belong either to an organisation that is part of the government or to a private foundation (Ferri et al., 2014). Since profit distribution is limited and stakes are generally not marketable, it is unlikely that the property right structure of cooperative and savings banks encourages profit-maximising behaviour (Amess, 2002). Furthermore, the lower incentives for stakeholder banks to adjust leverage in an attempt to boost equity returns (Ayadi et al., 2009) and the greater challenges—at least for cooperative banks—to raise external funds (Casu and Gall, 2016) may make them less inclined

to risk taking than their shareholder counterparts.

In accordance with theoretical predictions, empirical evidence highlights some important differences in the risk appetite of shareholder banks vis-à-vis stakeholder banks. Early findings for the US suggest that mutually owned intermediaries tend to hold safer loan portfolios (Verbrugge and Goldstein, 1981) and lower amounts of Real Estate Owned (REO) property (O'Hara, 1981) compared to stock associations. In a similar vein, joint-stock banks are found to focus more on the lines of business and geographic areas with the greatest risk (Lamm-Tennant and Starks, 1993), along with having the propensity to implement high-risk strategies by investing in risk assets and mismatching the duration of their assets and liabilities (Esty, 1997). Additional evidence on the link between ownership type and bank risk is reported for Europe, where shareholder banks coexist with a large—sometimes predominant—stakeholder banking sector (Ferri et al., 2013). Support exists for cooperative and savings banks having better loan quality (Iannotta et al., 2007), lower insolvency risk (García-Marco and Robles-Fernández, 2008) and fewer non-performing loans (Beck et al., 2009) relative to their commercial peers. More importantly, stakeholder banks appear to be more stable than shareholder banks on a variety of measures, such as volatility of earnings (Casu and Gall, 2016) and distance to default (Ayadi et al., 2009, 2010; Hesse and Cihák, 2007).

Taking the literature on the ownership structure–bank risk nexus as the point of departure, a handful of studies have endeavoured to uncover the extent to which the presence of stakeholder banks has a bearing on the stability of their shareholder counterparts. By considering a sample of banks from 29 industrialised countries, Hesse and Cihák (2007) find that a higher share of cooperative banks (as measured in terms of total assets) is generally associated with an increase in stability of an average bank in the system. However, they also show that the stability of weak commercial banks is negatively affected by a greater presence of cooperative banks. Similar evidence is provided by Chiaramonte et al. (2015), who build a panel of

banks from 26 developed economies and offer support for the stabilising role played by stakeholder banks during the crisis years (yet only beyond a certain market-share threshold). Consistent with these findings, a growing strand of the literature has highlighted the benefits of ownership diversity for the stability of the financial system (e.g. Ferri et al., 2014; Haldane and May, 2011; Llewellyn, 2017). Particularly important for the present discussion are the implications of diversity for bank competition. According to Berry et al. (2015), greater ownership diversity in the banking system may induce financial intermediaries to compete for higher customer satisfaction rather than increased equity returns. In addition, the findings by Kick and Prieto (2015) suggest that improved competition due to a more ownership-diverse banking system is likely to result in greater incentives for the private sector to discipline banks, possibly reducing the ability of financial intermediaries to shift their portfolios towards riskier positions. Moreover, Meriläinen (2016) argues that the nature of competition (and, thus, the degree of ownership diversity) shapes banks' decisions over the relative weight given to profitability vis-à-vis social objectives. Taken together, these arguments give rise to the following hypothesis:

Hypothesis 1. The higher the degree of ownership diversity in the banking system, the lower the incentives for financial intermediaries to take on risk.

It follows from the previous hypothesis that ownership diversity might interact with monetary policy in determining the risk-taking incentives of banks. Support for the moderating impact of bank ownership on monetary policy transmission exists in the literature. In examining the lending policies of banks with different forms of ownership, Ferri et al. (2014) collect data for the euro area and submit that stakeholder banks curtail their loan supply to a minor extent than shareholder banks after a contractionary monetary policy. Within the context of the risk-taking channel, recent evidence of the implications of ownership type for the relationship

between interest rates and bank risk is advanced by Drakos et al. (2016). Focusing on a sample of retail banks from 10 Central and Eastern European (CEE) countries alongside Russia, they show that the risk appetite of foreign banks from the former countries is the most affected by varying short-term rates. Therefore, insofar as the ownership composition of the banking industry has a bearing on the risk decisions of banks, one would expect the strength of the risk-taking channel to be diminished in countries with more diverse banking systems.

Hypothesis 2. The higher the degree of ownership diversity in the banking system, the lower the impact of monetary policy on financial intermediaries' risk taking.

4.3 Data and Methods

4.3.1 Sample Construction

I collect banks' balance sheet and income statement data from Bankscope, a financial database provided by Bureau van Dijk. The sample consists of a panel of banks located in the 15 economies that entered the European Union prior to the 2004 enlargement (i.e. Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden and the UK) plus Norway and Switzerland. I gather annual reports covering the period from 1999 (the year corresponding to the launch of the euro) to 2011 (the latest year for which data on the regulatory variables is available).[1] All financial intermediaries included by Bankscope in the categories 'commercial banks', 'savings banks', 'cooperative banks', 'real estate and mortgage banks', 'specialised governmental credit institutions' and 'bank holdings and holding companies' were initially selected. To alleviate survivorship bias, I used unconsolidated statements whenever available (otherwise consolidated) for banks that were active at least one year over the 1999–2011 pe-

[1]Support for the use of annual data when examining the risk-taking channel of monetary transmission is offered by Delis and Kouretas (2011) and Brissimis et al. (2014).

riod.[2] As the analysis involves deposit-taking and loan-making institutions, banks that did not report data on either deposits or loans were dropped. Furthermore, the holding company was excluded if accounts for the bank itself were available, while subsidiaries of banks reporting at the consolidated level were not included.

Although the initial ownership categories were drawn from Bankscope, a series of major refinements were made. First, I reclassified most of the Swiss cooperatives belonging to the Raiffeisen Group, given that they had been included among savings banks. Similarly, a number of the German *Volksbanken* that had been categorised as savings banks were moved to the set of cooperative institutions. Several intermediaries that were originally classified as specialised governmental credit institutions, such as Swiss *Kantonalbanken* and German *Landesbanken*, were added to the list of savings banks. In addition, the group of cooperative banks was expanded to comprise building societies from the UK and Ireland that endured the increasing trend of demutualisation and consolidation, since they are owned by their customers (Casu and Gall, 2016). As a next step, I ensure that the results are not affected by Mergers and Acquisitions (M&As) by examining the M&A history of all financial intermediaries included in the sample. To this end, information on M&As was obtained from Bankscope and supplemented with data retrieved from Thomson Reuters' SDC Platinum. Following the literature (e.g. Claessens and van Horen, 2014), banks that were targets of completed M&As stayed in the sample until the year preceding the takeover, whilst for the period following the transaction only the accounts of the new entity were retained. As a result, I ended up with an unbalanced panel of 5,677 shareholder and stakeholder banks that are located and operate in Western Europe. The final sample consists of 1,502 commercial banks, 2,954 cooperative banks and 1,221 savings banks. Table 4.1 details the number of

[2]While the choice of favouring unconsolidated statements finds its main justification in the predominance of unconsolidated data among the sample banks, the use of unconsolidated accounts also allows to derive more accurate estimations of ownership diversity for the selected countries (in that foreign subsidiaries are not included).

banks by country and ownership type. Whilst commercial banks are largely present in Luxembourg, the Netherlands and Ireland, they are somewhat underrepresented in countries such as Germany, Austria and Italy. In these countries, stakeholder banks in general and cooperative banks in particular appear to be a major player. Outside the eurozone, commercial banks are found to dominate the UK financial system, while savings banks constitute the vast majority of banking firms in Norway, Sweden and Denmark. In a nutshell, these cross-country differences seem to offer preliminary support for the need to develop measures that can effectively quantify the degree of ownership diversity in the banking system. This is one of the main contributions of this paper and is described in the next section.

4.3.2 Variable Definition

4.3.2.1 Ownership Diversity

A long-held tenet in ecology is that the degree of diversity (or heterogeneity) of an ecosystem can largely influence its dynamics (Tilman and Downing, 1994). As Magurran (2004, p. 8) suggests, biological diversity—often denoted as 'alpha diversity' (Whittaker, 1972)—refers to "the variety and abundance of species in a defined unit of study". While richness corresponds to the number of species within a given community (Bandeira et al., 2013), evenness captures the extent to which the abundance is equal across species (Molinari, 1989). A well-accepted definition of diversity is the effective number of types (Hill, 1973), according to which 'true diversity' (D) of species (S) is given by the inverse of the weighted generalised mean of their proportional abundances (p_i). In formal terms:

$$ {}^{q}D = ({}^{q}\overline{p}_i)^{-1} = \left(\sqrt[q-1]{\sum_{i=1}^{S} p_i p_i^{q-1}} \right)^{-1} = \left(\sum_{i=1}^{S} p_i^q \right)^{1/(1-q)} \tag{4.1} $$

Table 4.1 Sample Composition by Country and Ownership Type

	Commercial banks	Cooperative banks	Savings banks	Total
AT	77	171	78	326
BE	52	12	11	75
DE	183	1607	598	2388
ES	88	87	61	236
FI	10	4	8	22
FR	186	165	13	364
GR	19	2	1	22
IE	23	3	0	26
IT	220	592	47	859
LU	126	2	2	130
NL	45	1	2	48
PT	39	4	3	46
EA-12	1068	2650	824	4542
DK	62	9	64	135
GB	175	68	8	251
SE	19	0	91	110
EU-15	1324	2727	987	5038
CH	159	225	110	494
NO	19	2	124	145
Total	1502	2954	1221	5677

Notes: The table specifies the number of banks by ownership type in each of the countries included in the sample. Values refer to the number of banks during the whole sample period (from 1999 to 2011). AT, Austria; BE, Belgium; DE, Germany; ES, Spain; FI, Finland; FR, France; GR, Greece; IE, Ireland; IT, Italy; LU, Luxembourg; NL, Netherlands; PT, Portugal; DK, Denmark; GB, United Kingdom; SE, Sweden; CH, Switzerland; NO, Norway. *EA-12* are the founding eurozone economies, namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. *EU-15* are the countries that entered the European Union prior to the 2004 enlargement, i.e. the *EA-12* economies, Denmark, Sweden and the UK. *Source*: Bankscope.

where q is the order of diversity. High values ($q > 1$) of this parameter emphasise abundance differences among species, whereas low values ($q < 1$) assign more weight to rare species (Tuomisto, 2010).[3]

Among the most commonly used measures of species diversity is the Simpson Index (Simpson, 1949). In its standard form, this index represents the probability that two individuals chosen randomly from an assemblage will belong to the same species. For this reason, the reciprocal of the Simpson Index (D') is recommended

[3]For $q = 0$, all species are considered to be equally abundant and diversity equals species richness ($^0D = S$).

for general application (Peet, 1974). It is calculated as:

$$D' = \left(\sum_{i=1}^{S} p_i^2 \right)^{-1} \tag{4.2}$$

An alternative diversity indicator that has found enduring support in the literature is the Shannon–Wiener Index (Shannon and Weaver, 1949). Originally developed in the field of information theory, it measures the average degree of uncertainty in predicting the species of unknown individuals drawn from a community. Whilst the Simpson Index places greater weight on the evenness component, the Shannon–Wiener Index is more sensitive to species richness (Nagendra, 2002).[4] For ease of interpretation, expression of the Shannon–Wiener Index in terms of its antilogarithm ($e^{H'}$) is suggested (Peet, 1974).[5] This index is given by:

$$e^{H'} = \exp \left[- \sum_{i=1}^{S} p_i \ln (p_i) \right] \tag{4.3}$$

Besides heterogeneity indices, the literature has proposed a number of measures aimed at quantifying species evenness. The common approach is to calculate evenness as the ratio between estimated and maximum diversity for a specific number of species and sample size (Kwak and Peterson, 2007). Since evenness indicators should be independent of species richness and take lower values within contexts characterised by more unequal abundance across species, Heip (1974) proposes the

[4] Hill (1973) shows that the Simpson Index and the Shannon–Wiener Index are special cases of the general index of diversity (Equation 4.1) with $q = 2$ and $q = 1$, respectively.

[5] An additional advantage of using the exponential form of the Shannon–Wiener Index is that it tends to be approximately normally distributed (Heip et al., 1998).

following index:[6]

$$E' = \frac{\left(e^{H'} - 1\right)}{(S - 1)} \tag{4.4}$$

Firms interact with each other and the environment in which they are embedded. The outcomes of these interactions have a bearing on their profitability and probability of survival (Baschieri et al., 2015). It follows that quantitative measures used in ecology may constitute valuable instruments for banking research. Building on the work by Michie and Oughton (2013), I treat ownership types (i.e. commercial, cooperative and savings) as analogous to species in an ecosystem and construct indices of ownership diversity for the loan and deposit markets. Data on bank loans and deposits are collected from Bankscope and used to compute ownership diversity measures based on the Simpson Index (*SIM*), Shannon–Wiener Index (*SHA*) and Heip Index (*HEI*) of biological diversity.[7] Table 4.2 reports the average degree of ownership diversity over the period from 1999 to 2011 for each of the sample countries. The values for the three indices suggest important cross-country differences with respect to the ownership composition of the banking system. Whereas countries such as Austria, Germany and Spain are characterised by relatively high levels of ownership diversity on both the loan and deposit sides of the market, much less diverse banking systems are found in Greece, Belgium and Ireland. Among non-euro-area countries, diversity in the UK loan market is almost half the corresponding value for Switzerland. Figure 4.1 depicts the trend in the Simpson Index for the loan and deposit markets in the largest European economies.[8] At a first glance, one

[6]Evidence is also found for the Heip Index (E') having considerably lower skewness and kurtosis relative to other evenness metrics (Heip and Engels, 1974).

[7]Loans are calculated as residential mortgage loans, other mortgage loans, other retail loans, business loans and other loans minus loan loss reserves. Deposits include customer deposits, deposits from banks, money market instruments, certificates of deposits and other deposits.

[8]Since for any given country and year the number of species (ownership types) is bounded between 0 and 3, the rest of the analysis uses primarily the Simpson Index. Compared to other measures, this index is shown to be more sensitive to changes in the maximum proportion among categories rather than in their number (McDonald and Dimmick, 2003) and is therefore well suited when the degree of dominance is of concern (Whittaker, 1972).

can notice that Italy has enjoyed a sustained increase in ownership diversity with respect to both sides of its banks' balance sheets. By contrast, there seems to have been a considerable loss of diversity in the UK, as tested by the 13.30% decrease in the index for the loan market in the run-up to the crisis (from its 2004 peak). A marked decrease in ownership diversity towards the end of the sample period can also be observed for Spain, where the collapse of the *cajas* in the aftermath of the crisis led to a significant reduction in savings banks' market shares. Most importantly, in 2011 the diversity measure for the whole sample has fallen by 11.65% (loan market) and 14.32% (deposit market) relative to 1999, pointing to a general decline in ownership diversity across Western European countries.

4.3.2.2 Bank Risk

The riskiness of banks is quantified through the Z-score (Z), a measure frequently used in the literature to describe insolvency risk (e.g. Bai and Elyasiani, 2013; Imbierowicz and Rauch, 2014; Laeven and Levine, 2009). One of the major advantages of this measure is that it does not require market values, a feature that is key to the present analysis due to the overwhelming majority of unlisted banks in the sample. The Z-score is a proxy for distance to default and corresponds to the number of standard deviations by which bank returns have to fall before equity is wiped out and the intermediary becomes insolvent. Accordingly, higher values indicate lower default risk (greater bank stability). As the Z-score is highly skewed, this study follows the literature (e.g. Dong et al., 2014) and applies its natural logarithm. Therefore, the proxy for bank risk becomes:

$$Z_{i,t} = \ln\left(\frac{ROA_{i,t} + CAR_{i,t}}{\sigma ROA_{i,T}}\right) \tag{4.5}$$

Table 4.2 Ownership Diversity by Country and Market Type

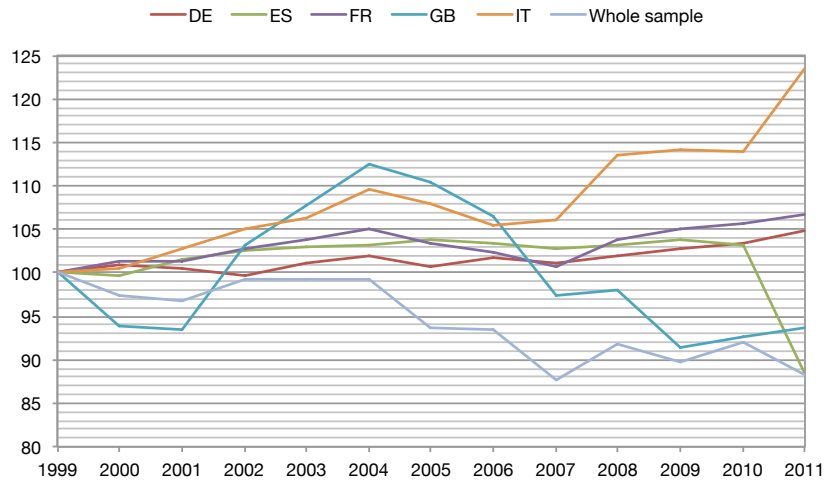
	Loans			Deposits		
	Simpson	Shannon–Wiener	Heip	Simpson	Shannon–Wiener	Heip
AT	2.839	2.912	0.956	2.835	2.909	0.955
BE	1.057	1.148	0.074	1.053	1.142	0.071
DE	2.553	2.720	0.860	2.608	2.755	0.877
ES	2.119	2.269	0.634	2.106	2.267	0.633
FI	1.980	2.166	0.583	1.778	2.042	0.521
FR	1.896	1.961	0.480	1.937	1.976	0.488
GR	1.043	1.111	0.075	1.076	1.165	0.109
IE	1.093	1.194	0.194	1.082	1.176	0.176
IT	1.698	2.058	0.529	1.595	1.938	0.469
LU	1.170	1.336	0.168	1.129	1.273	0.136
NL	1.659	1.799	0.530	1.709	1.832	0.561
PT	1.168	1.331	0.165	1.135	1.290	0.145
EA-12	2.354	2.630	0.815	2.329	2.619	0.810
DK	1.109	1.231	0.115	1.135	1.280	0.140
GB	1.280	1.456	0.228	1.250	1.421	0.211
SE	1.151	1.286	0.286	1.089	1.191	0.191
EU-15	2.090	2.445	0.723	2.088	2.445	0.723
CH	2.087	2.353	0.676	1.570	1.900	0.450
NO	1.830	1.948	0.569	1.705	1.850	0.515
Whole sample	2.092	2.444	0.722	2.045	2.412	0.706

Notes: The table summarises the degree of ownership diversity for the loan and deposit markets in each of the countries included in the sample. Values correspond to the annual average of the corresponding index over the whole sample period (from 1999 to 2011). Higher values denote greater ownership diversity. *Loans* are computed as residential mortgage loans, other mortgage loans, other retail loans, business loans and other loans minus loan loss reserves. *Deposits* are the sum of customer deposits, deposits from banks, money market instruments, certificates of deposits and other deposits. AT, Austria; BE, Belgium; DE, Germany; ES, Spain; FI, Finland; FR, France; GR, Greece; IE, Ireland; IT, Italy; LU, Luxembourg; NL, Netherlands; PT, Portugal; DK, Denmark; GB, United Kingdom; SE, Sweden; CH, Switzerland; NO, Norway. *EA-12* are the founding eurozone economies, namely Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. *EU-15* are the countries that entered the European Union prior to the 2004 enlargement, i.e. the *EA-12* economies, Denmark, Sweden and the UK. *Source*: Bankscope.

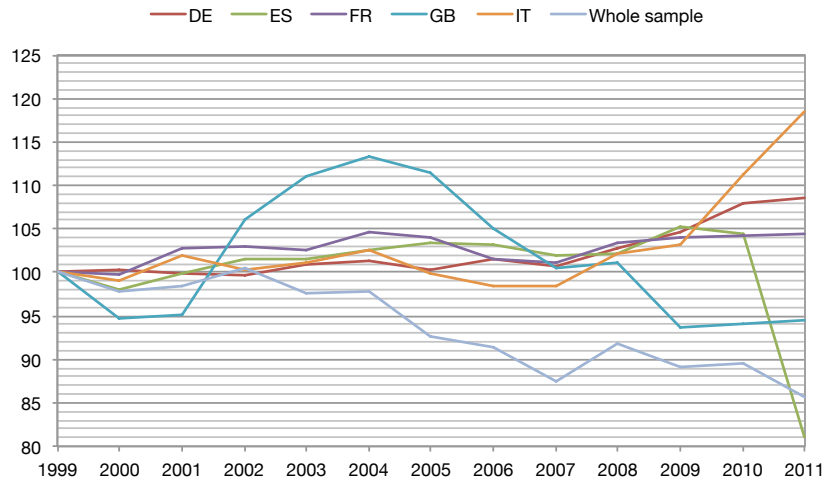
where ROA is the Return On Assets and CAR is the Capital-to-Asset Ratio for bank i at time t.[9] Summary statistics for the Z-score are presented in Table 4.3.[10]

[9] Alternatively, a time-varying Z-score à la Lepetit and Strobel (2013) is constructed, which relies on mean and standard deviation estimates of ROA computed over the full sample and combines them with current values of CAR. The results of this exercise, not reported to save space but available on request, are in line with the benchmark estimations.

[10] To reduce the influence of outliers, all accounting variables are winsorized at the 1st and 99th percentiles of their sample distributions.



(a) Loans



(b) Deposits

Figure 4.1 Ownership Diversity in Selected Countries

Notes: The charts illustrate the evolution of the Simpson Index for the loan and deposit markets, respectively, over the period from 1999 to 2011 (with 1999 = 100) in the major European economies. DE, Germany; ES, Spain; FR, France; GB, United Kingdom; IT, Italy. *Source*: Bankscope.

Throughout the sample period, the risk measure has a mean value of 3.594 and a standard deviation of 1.090. A sharp decline in the Z-score occurred between 1999 and 2004, during which the distance to default for an average bank decreased from 3.610 to 3.536. This suggests a 2.05% rise in the average risk appetite of financial

intermediaries in the first half of 2000s. Insolvency risk experienced a slight reduction in the period near the onset of the crisis, while it increased again during the crisis years.

Table 4.3 Summary Statistics

Variable	Notation	Description	Source	Mean	SD	Min	Max
Bank risk							
Z-score	*Z*	Natural logarithm of the Return On Assets (*ROA*) plus the Capital-to-Asset Ratio (*CAR*) divided by the standard deviation of *ROA*.	Bankscope	3.594	1.090	-0.297	7.278
Monetary policy							
Taylor rule residuals	*TR*	Residuals from a regression of the overnight interbank rate on GDP growth and inflation.	Datastream; national data; OECD	0.534	3.564	-7.197	9.585
Ownership diversity							
Simpson Index	*SIM_L*	Simpson Index of ownership diversity for the loan market.	Bankscope	2.131	0.520	1.008	2.961
Shannon–Wiener Index	*SHA_L*	Shannon–Wiener Index of ownership diversity for the loan market.	Bankscope	2.323	0.498	1.027	2.980
Heip Index	*HEI_L*	Heip Index of ownership diversity for the loan market.	Bankscope	0.667	0.243	0.027	0.990
Bank-level controls							
Stakeholder	*STAKE*	Dummy that equals 1 for either cooperative or savings banks and 0 otherwise.	Bankscope	0.766	0.424	0.000	1.000
Size	*SIZE*	Natural logarithm of total assets (divided by the GDP deflator).	Bankscope; WDI	6.569	1.722	2.481	12.462
Liquidity	*LIQ*	Ratio of liquid assets to total assets.	Bankscope	19.978	17.958	0.590	92.240
Leverage	*LEV*	Ratio of liabilities to total assets.	Bankscope	91.066	8.041	20.886	98.926
Profitability	*ROE*	Ratio of net income to average equity.	Bankscope	5.683	7.340	-48.247	38.773
Asset diversity	*DIV*	One minus the ratio of net loans minus other earning assets to total earning assets.	Bankscope	0.574	0.261	0.000	0.993
Country-level controls							
Concentration	*CONC*	Sum of assets of the three largest banks as a share of total assets of commercial, cooperative and savings banks in the country.	Bankscope	41.443	17.383	21.145	96.671

Table 4.3 *(Continued)*

Variable	Notation	Description	Source	Mean	SD	Min	Max
Activity restrictions	*ACT*	Index of the degree to which national regulatory authorities restrict banks from engaging in securities activities, insurance activities, real estate activities and ownership of non-financial firms.	Barth et al. (2001, 2004, 2006, 2012); BRSS	6.662	2.755	2.000	12.000
Capital requirements	*CAPR*	Index of the stringency of regulatory capital requirements.	Barth et al. (2001, 2004, 2006, 2012); BRSS	6.148	1.595	2.000	9.000
Supervisory power	*SUP*	Index of the power of the official supervisory authority to affect bank behaviour.	Barth et al. (2001, 2004, 2006, 2012); BRSS	9.598	2.261	4.000	14.000
Private monitoring	*PRIV*	Index of the extent to which regulatory and supervisory policies encourage the private monitoring of banks.	Barth et al. (2001, 2004, 2006, 2012); BRSS	7.946	0.852	5.000	10.000
GDP growth	*GDP*	Annual growth rate of real GDP.	WDI	1.544	2.387	-8.864	10.201
Stock market returns	*MKT*	Annual change in the total return index for non-financial corporations (divided by the GDP deflator).	Datastream	4.576	19.753	-45.227	94.275

Notes: The table provides the notation, description and summary statistics for the main variables used in the analysis. The sample period goes from 1999 to 2011.

4.3.2.3 Monetary Policy

Monetary conditions are proxied by a measure of monetary policy shocks often used in the literature (e.g. Brissimis et al., 2014; Maddaloni and Peydró, 2011, 2013), that is, Taylor rule residuals (TR). This measure captures the unexpected component of fluctuations in policy rates (Brissimis et al., 2014), while allowing for cross-sectional variation in monetary conditions (Maddaloni and Peydró, 2013). For this reason, Taylor rule residuals appear to be well suited to my empirical setting, which is characterised by identical monetary policy rates in the eurozone but different economic conditions (e.g. in terms of GDP growth and inflation) across euro-area countries. The residuals are computed by estimating the following equation:

$$OR_{j,t} = \alpha + \beta GDP_{j,t} + \gamma INFL_{j,t} + \delta_t + \varepsilon_{j,t} \tag{4.6}$$

where $OR_{j,t}$ is the quarterly average of the daily overnight interbank rate (e.g. EONIA for the eurozone countries), $GDP_{j,t}$ is the growth rate of real GDP, $INFL_{j,t}$ is the inflation rate (measured as the percentage change in the CPI) and δ_t is a time trend. I use quarterly data for the period 1999:Q1–2011:Q4 collected from Datastream and national sources (overnight interbank rate) as well as from the OECD (GDP growth and inflation). Taylor rule residuals are estimated with a Panel Least Squares (PLS) regression for the eurozone economies (i.e. Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain) and via separate Ordinary Least Squares (OLS) regressions for the other economies (i.e. Denmark, Norway, Sweden, Switzerland and the UK).[11] Consistent with Olivero et al. (2011a), the annual indicator of monetary policy shocks is obtained by summing the residuals from the interest rate equation over the four quarters in each year. Positive (negative) Taylor rule residuals denote a tight (loose)

[11] Following Maddaloni and Peydró (2011, 2013), I impose common coefficients for the euro area countries due to the single monetary policy.

monetary environment. Descriptive statistics for the monetary policy variable are reported in Table 4.3. Figure 4.2 illustrates Taylor rule residuals over the period from 1999:Q1 to 2011:Q4 for the economies included in the sample.[12] The movements in the residuals suggest high commonality in the conduct of monetary policy among the selected countries. Taylor rule residuals declined remarkably in the period after the dot-com bust, reaching their lowest levels around 2004. Monetary policy became tighter in the period immediately preceding the start of the crisis, before moving back to approximately the 2004 levels in the quarters following the collapse of Lehman Brothers. The lowest value of Taylor rule residuals is observed for Norway in the third quarter of 2004 (-2.041), whereas the highest is found for the UK in the third quarter of 2007 (2.750).

4.3.2.4 Other Explanatory Variables

I attempt to mitigate omitted-variable bias by including a number of bank- and country-level controls that are deemed to influence bank risk. Among the bank-specific variables is a dummy for ownership structure ($STAKE$), which equals 1 for stakeholder banks and 0 otherwise. In light of the lower incentives for cooperative and savings banks to take on risk (Ayadi et al., 2009; Groeneveld and Llewellyn, 2012), one may predict a positive relationship between the proxy for ownership type and bank stability. The inclusion of the ownership dummy is aimed at disentangling the effects that individual bank ownership has on the risk-taking incentives of financial intermediaries from those that are associated with the ownership composition of the banking system as a whole, thereby allowing to investigate the extent to which the presence of stakeholder banks has a bearing on the risk decisions of shareholder banks. To capture the potential for a 'too-big-to-fail' phenomenon, I account for bank size ($SIZE$) by considering the natural logarithm of real total as-

[12] In Figure 4.2, Taylor rule residuals for the euro area are calculated as a weighted average based on each country's GDP.

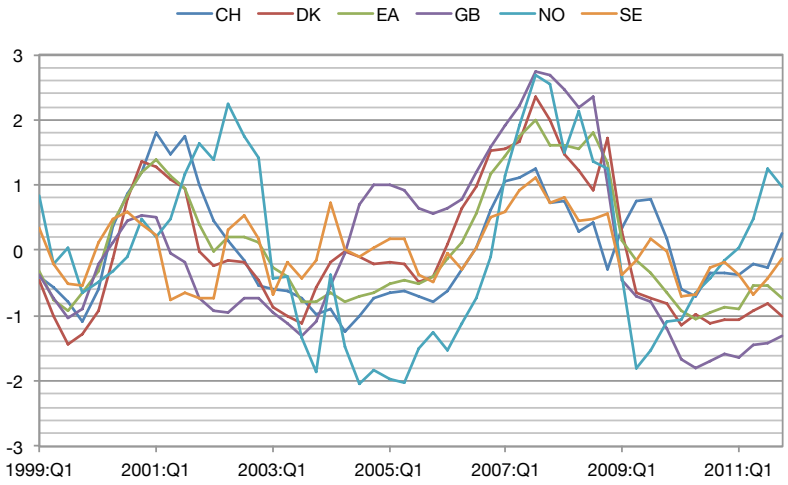


Figure 4.2 Taylor Rule Residuals

Notes: The figure depicts Taylor rule residuals in the period from 1999:Q1 to 2011:Q4. Taylor rule residuals are the residuals from a regression of the overnight interbank rate on GDP growth and inflation. The residuals are estimated with a PLS regression for the euro area countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain) and with separate OLS regressions for the other countries (Denmark, Norway, Sweden, Switzerland and the UK). For the euro area, a weighted average is computed using each country's GDP. Positive (negative) Taylor rule residuals denote a contractionary (expansionary) monetary policy. CH, Switzerland; DK, Denmark; EA, euro area; GB, United Kingdom; NO, Norway; SE, Sweden. *Sources*: Datastream; national data; OECD.

sets. I do not have a clear a priori assumption about this variable, as the literature provides conflicting evidence on the size–insolvency risk nexus (Bai and Elyasiani, 2013; García-Kuhnert et al., 2015). Furthermore, evidence exists that access to liquidity by financial intermediaries has a bearing on their risk taking (Forssbæck, 2011; Ioannidou et al., 2015). To measure liquidity (LIQ), the ratio of liquid assets to total assets is calculated.[13] Since theory points to leverage as one of the main mechanisms through which asset risk can be altered (Acharya et al., 2009), the ratio of liabilities to total assets is added as an indicator of bank leverage (LEV). Whilst leverage might increase the target level of default risk due to the improved payoff from risky investments (Jensen and Meckling, 1976), higher leverage might reflect a

[13]Liquid assets are the sum of loans and advances to banks, reverse repos and cash collateral, securities classified as held for trading (excluding derivatives) and cash and due from banks.

lower risk-taking ability on the part of financial intermediaries and discourage them from engaging in risk behaviour (Shrieves and Dahl, 1992). Likewise, the incentives for banks to take on risk are likely to depend on their past performance (Casu et al., 2011; Mohsni and Otchere, 2014). For this reason, I control for the ratio of net income to average equity (ROE). In turn, diversification away from lending might be related to reduced bank stability (Chiaramonte et al., 2015; Hesse and Cihák, 2007). To this end, I employ the measure of asset diversity (DIV) developed by Laeven and Levine (2007), which is computed as:

$$DIV_{i,t} = 1 - \left| \frac{Net\ loans_{i,t} - Other\ earning\ assets_{i,t}}{Total\ earning\ assets_{i,t}} \right| \tag{4.7}$$

At the country level, I account for market concentration ($CONC$), corresponding to the share of assets of the three largest banks in the system.[14] The literature offers little guidance on the impact of concentration on distance from insolvency, as support is found for more concentrated markets being associated with either higher or lower degrees of bank stability (Beck et al., 2006; Schaeck et al., 2009). To account for the regulatory environment, I derive four indices from the *Bank Regulation and Supervision Survey* (BRSS) by the World Bank (Barth et al., 2001, 2004, 2006, 2012).[15] Activity restrictions (ACT) reflects the degree to which banks are allowed to engage in securities activities, insurance activities, real estate activities and ownership of non-financial firms. Greater regulatory restrictions are shown to either reduce bank riskiness (Lee and Hsieh, 2013) or increase the fragility of the system by restraining banks from entering non-traditional lines of business (Beck et al., 2006). Capital requirements ($CAPR$) describes the stringency of regulatory capital requirements. Although one would generally expect greater oversight of bank capital to result in

[14]The results of the baseline estimations are confirmed if the five-bank concentration ratio is considered instead.

[15]The data used to compute the regulatory variables is available at four points in time (i.e. 2001, 2003, 2007 and 2011) and spans the 1999–2011 period (Barth et al., 2013).

less risk taking on the part of financial intermediaries (Keeley and Furlong, 1990), the opposite might hold if stricter capital requirements lead banks to shift their portfolios towards riskier structures via changes in the risk–return frontier (Koehn and Santomero, 1980). Supervisory power (SUP) proxies for the right of the official supervisory authority to take actions aimed at changing bank behaviour, such as initiating legal action against external auditors, ordering the bank management to constitute provisions for actual or potential losses and superseding shareholder rights in case of bank restructuring. I do not have an a priori assumption about the link between supervisory power and bank risk, since the evidence available in the literature is somewhat ambiguous (Lee and Hsieh, 2013; Vallascas and Hagendorff, 2013). Private monitoring ($PRIV$) captures the incentives on the part of private investors to monitor and exert effective governance over banks. While some findings appear to indicate that greater monitoring by private agents limits risk-taking incentives at banks (Delis and Kouretas, 2011), more recent evidence uncovers a positive relationship between private monitoring and risk assets (Drakos et al., 2016). Moreover, the literature suggests that the macroeconomic environment is important in explaining the risk appetite of banks (Chalermchatvichien et al., 2014; Williams, 2014). Therefore, I control for general economic conditions by including the annual growth rate of real GDP (GDP). In a similar vein, I attempt to disentangle the risk-taking channel from the standard 'financial accelerator' (Bernanke et al., 1999), which affects bank lending decisions through financial frictions on the side of borrowers. To this purpose, the empirical setup accounts for the annual change in real stock market returns for the non-financial sector (MKT).[16]

[16]The correlation coefficients for the variables used in the analysis are reported in Appendix Table C.1.

4.3.3 Model and Estimation Method

The benchmark model is given by the following equation:

$$BR_{i,t} = \alpha + \Gamma BR_{i,t-1} + \Theta MP_{j,t} + \Upsilon OD_{j,t} + \Phi MP_{j,t} \times OD_{j,t} + \sum_{k=1}^{K} \Psi_k BC_{k,i,t} + \sum_{m=1}^{M} \Omega_m CC_{m,j,t} + \zeta_j + \eta_t + \varepsilon_{i,t} \quad (4.8)$$

with $i = 1, ..., N$, $j = 1, ..., 17$ and $t = 1, ..., T$, where N is the number of banks, j is the country and T is the final year. The dependent variable, $BR_{i,t}$, represents the probability of default for bank i at time t and is measured by the Z-score. According to the literature (Delis and Kouretas, 2011; Fiordelisi et al., 2011), financial intermediaries' risk taking may persist over time and deviate from its equilibrium level in the short term. If bank risk is indeed persistent, estimates based on a static model may be biased and an econometric approach that explicitly incorporates the dynamics of bank risk should be used. Therefore, the first lag of the dependent variable, $BR_{i,t-1}$, is included on the right-hand side of Equation 4.8.[17] Monetary policy, $MP_{j,t}$, is captured by Taylor rule residuals. Consistent with the literature on the risk-taking channel (e.g. Ioannidou et al., 2015; Jiménez et al., 2014), I anticipate a positive sign on the coefficient Θ. As central banks loosen monetary conditions, financial intermediaries react by lowering their distance to default (increasing their risk exposure). $OD_{j,t}$ is one of the proxies for ownership diversity, namely the Simpson Index, Shannon–Wiener Index or Heip Index. Following hypothesis 1, one would expect the coefficient Υ to be positive. To test the extent to which the ownership composition of the banking system has a bearing on the strength of the risk-taking channel, monetary policy is interacted with the ownership diversity variable.[18] As

[17] I also experiment with further lags of the dependent variable among the regressors, but only the coefficient on the first lag is found to be statistically significant.

[18] To reduce multicollinearity, the monetary policy and ownership diversity variables are mean-

hypothesis 2 predicts, the coefficient Φ should be negative. All econometric specifications include a vector of K-bank-, $BC_{k,i,t}$, and M-country-level, $CC_{m,j,t}$, control variables, which gauge the average impact that a number of factors at the bank and country levels have on intermediaries' insolvency risk in the 17 economies. Finally, ζ_j and η_t are country and time fixed effects, respectively, aimed at controlling for unobservable country-specific factors and time-varying common shocks that may affect bank risk.

Several studies have recognised the potential for endogeneity when examining the risk-taking channel (Altunbas et al., 2014; Jiménez et al., 2014), since monetary authorities might also respond to the financial stability of the banking sector. In econometric terms, this implies that the monetary policy variable, $MP_{j,t}$, may be correlated with the error term, $\varepsilon_{i,t}$, and that estimates based on OLS regressions may be biased. Another source of concern is the inclusion of the lagged dependent variable as a regressor in the econometric specifications, which may cause autocorrelation in the residuals and lead to biased estimates (Aebi et al., 2012). To address these concerns, Equation 4.8 is estimated with the Generalised Method of Moments (GMM) for dynamic panel data proposed by Arellano and Bover (1995) and Blundell and Bond (1998).[19] This estimator allows to exploit the dynamic nature of the relationships being investigated, while producing consistent and unbiased estimates under the condition that there is no second-order serial correlation and that the instruments are valid (Wintoki et al., 2012). Two main tests are conducted to ensure that the econometric models are correctly specified. The first test is the Arellano–Bond test for autocorrelation of order two, with a null hypothesis of no second-order correlation in differenced residuals. The second test is the Hansen test of overidentifying restrictions, which verifies that the instruments are uncorrelated

centred before the multiplicative term is formed.

[19]Since the GMM estimator is designed for 'small T, large N' panels (Roodman, 2009), that is, panels characterised by a relatively short time dimension and a large number of units, it appears to be well suited to my empirical setup.

with the error term (i.e. they are exogenous).[20] In line with existing literature on the risk-taking channel (e.g. Delis and Kouretas, 2011), I take the lagged dependent, Taylor rule residuals (as well as its interaction with ownership diversity) and all the bank-level control variables with the exception of the ownership dummy and bank size to be endogenous. This means that their second and deeper lags can be included as instruments. Moreover, the ownership diversity indices, bank size and the measures capturing the regulatory environment are treated as predetermined, implying that these variables can be instrumented with their first and longer lags. To limit the number of instruments, all the remaining variables are considered to be exogenous. I use the two-step procedure with Windmeijer (2005) standard errors corrected for finite samples and clustered at the bank level.[21]

4.4 Results

4.4.1 Baseline Estimations

The results of the baseline regressions are shown in Table 4.4. In each column, a different measure of ownership diversity (i.e. the Simpson Index, Shannon–Wiener Index and Heip Index) for the loan market is used. The validity of the selected instruments is confirmed by the Hansen test of overidentifying restrictions, Hansen χ^2 (p-value), while serial correlation of order two, $AR(2)$, is rejected by the Arellano–Bond test for autocorrelation in the error terms. The coefficient on the lagged dependent variable reveals that bank risk taking is highly persistent, thereby reinforcing the need to account for the dynamic nature of bank risk. In line with the theoretical underpinnings of the risk-taking channel (Angeloni et al., 2015; Borio and

[20] These specification tests, alongside the Wald χ^2 test of overall model fit and the Arellano–Bond test for first-order serial correlation, are reported at the end of each table presented in the next section.

[21] The panel regressions are run with the *xtabond2* command in Stata. To reduce the instrument count, I limit lag depth and use a collapsed instrument matrix as suggested by Roodman (2009). Prior to conducting the estimations, Fisher-type (Choi, 2001) tests are also performed to verify that the continuous variables used in the analysis are stationary.

Zhu, 2012), the coefficient on *TR*—which captures the average impact of monetary policy shocks on banks' probability of default among the sample countries—takes a positive and highly significant value in all specifications. This evidence confirms that looser monetary conditions induce financial intermediaries to operate closer to default. Support for the first hypothesis is provided by the positive and strongly significant coefficients of the proxies for ownership diversity, particularly when the Simpson Index is considered (0.391). In a nutshell, these results suggest that—ceteris paribus—banks located in countries with greater diversity of ownership types tend to be more stable relative to those operating in less diverse banking systems. This influence goes beyond that originating from individual bank ownership and points to a twofold route to financial stability, in that a higher presence of stakeholder banks in the system appears to impact on the risk-taking activities of shareholder banks. Most importantly, this paper finds that ownership diversity buffers the effects of unexpected monetary policy shocks on bank risk, as denoted by the negative and highly significant coefficients on the interaction terms ($0.017 - 0.017 = 0.000$ if ownership diversity is measured by *SIM_L*). This corroborates the second hypothesis, in that, monetary transmission via the risk-taking channel appears to be less pronounced in banking systems characterised by a multiplicity of ownership structures.

Looking at the bank-level controls, the results indicate that cooperative and savings banks have on average lower insolvency risk than their commercial peers, consistent with the role of stakeholder banks as important contributors to financial stability (Ayadi et al., 2010; Ferri et al., 2014; Llewellyn, 2017). Bank size is found to be positively related to distance to default, thereby rejecting the 'too-big-to-fail' hypothesis. Whereas some evidence exists that more liquid banks are likely to be more stable than their counterparts with less liquid balance sheets, ex ante greater leverage does not seem to deter financial intermediaries from taking on additional risk. As expected, past performance is found to influence risk taking by banks, with higher equity returns curtailing the incentives on the part of intermedi-

Table 4.4 Baseline Estimations

	Dependent variable: Z-score (Z)		
Independent variable	Simpson Index	Shannon–Wiener Index	Heip Index
Lagged Z	0.952***	0.940***	0.906***
	(0.026)	(0.030)	(0.028)
TR	0.017***	0.016**	0.014***
	(0.006)	(0.008)	(0.005)
SIM_L	0.391***		
	(0.149)		
TR × *SIM_L*	-0.017***		
	(0.002)		
SHA_L		0.351*	
		(0.201)	
TR × *SHA_L*		-0.017***	
		(0.002)	
HEI_L			0.285***
			(0.108)
TR × *HEI_L*			-0.034***
			(0.004)
Bank-level controls			
STAKE	0.151***	0.114**	0.205***
	(0.040)	(0.058)	(0.060)
SIZE	0.021**	0.026**	0.031***
	(0.011)	(0.012)	(0.010)
LIQ	0.002**	-0.001	0.001
	(0.001)	(0.002)	(0.002)
LEV	-0.007**	-0.008**	-0.010***
	(0.003)	(0.004)	(0.003)
ROE	0.008***	0.006***	0.010***
	(0.002)	(0.002)	(0.002)
DIV	0.015	0.102	0.049
	(0.067)	(0.077)	(0.076)
Country-level controls			
CONC	0.012***	0.011***	0.008***
	(0.002)	(0.001)	(0.001)
ACT	0.037***	0.036***	0.037***
	(0.006)	(0.006)	(0.006)
CAPR	-0.022***	-0.007	0.004
	(0.007)	(0.007)	(0.005)
SUP	-0.028***	-0.032***	-0.024***
	(0.005)	(0.006)	(0.004)
PRIV	-0.046***	-0.052***	-0.047***
	(0.008)	(0.010)	(0.009)
GDP	0.016***	0.016***	0.015***
	(0.003)	(0.003)	(0.002)
MKT	0.001**	0.000*	0.001**
	(0.000)	(0.000)	(0.000)
# of observations	40088	40088	40088
# of instruments	58	58	58

Table 4.4 *(Continued)*

	Dependent variable: Z-score (Z)		
	Simpson Index	Shannon–Wiener Index	Heip Index
Wald χ^2 (p-value)	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000
$AR(2)$	0.704	0.929	0.852
Hansen χ^2 (p-value)	0.117	0.112	0.313

Notes: The table reports the results of the baseline estimations. Z is a proxy for distance from insolvency; *TR* are the residuals from a regression of the overnight rate on GDP growth and inflation; *SIM_L* is the Simpson Index of ownership diversity for loans; *SHA_L* is the Shannon–Wiener Index of ownership diversity for loans; *HEI_L* is the Heip Index of ownership diversity for loans; *STAKE* is a dummy that equals 1 for stakeholder banks and 0 otherwise; *SIZE* is the natural logarithm of real total assets; *LIQ* is the ratio of liquid assets to total assets; *LEV* is the ratio of liabilities to total assets; *ROE* is the Return On Equity; *DIV* is a measure of asset diversification; *CONC* is the share of assets of the three largest banks in the country; *ACT* is an index of the regulatory restrictiveness on bank activities; *CAPR* is an index of the stringency of bank capital regulations; *SUP* is an index of the power of the official supervisory agency to change bank behaviour; *PRIV* is an index of the incentives for private investors to monitor banks; *GDP* is the annual growth rate of real GDP; *MKT* is the annual change in real stock market returns for non-financial corporations; Wald χ^2 (p-value) is the Wald χ^2 test of overall model fit; $AR(1)$ is the Arellano–Bond test for first-order serial correlation; $AR(2)$ is the Arellano–Bond test for second-order serial correlation; Hansen χ^2 (p-value) is the Hansen test of overidentifying restrictions. All regressions are estimated with the two-step system GMM for dynamic panels and include country- as well as time-specific effects. Windmeijer (2005) finite-sample corrected standard errors (clustered by bank) are reported in parentheses. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

aries to increase their risk exposure. At the country level, support is offered to the concentration–stability hypothesis (Beck et al., 2006), as banks operating in more concentrated markets tend to have less risky balance sheets than banks operating in less concentrated ones. With respect to the regulatory environment, greater restrictiveness on bank activities is found to discourage financial intermediaries from engaging in risk taking, while stricter capital requirements do not seem to be effective in limiting banks' appetite for risk. Interestingly, a more stringent regulatory environment in terms of the power of the supervisory agency and private monitoring appears to have a negative impact on banks' distance to default, possibly because of the additional constraints it exerts on financial intermediaries' behaviour. In addition, positive economic circumstances as gauged by the growth rate of real GDP tend to be associated with higher bank stability, lending support to the view that

increased economic growth is likely to lower bank risk by providing access to risk management techniques (Williams, 2014). In accordance with expectations from the literature (Altunbas et al., 2014), a boost in the value of collateral generated by an increase in borrowers' stock market returns lowers the probability of financial intermediaries becoming insolvent.

4.4.2 Robustness Checks

The sensitivity of the results is examined in several ways. As a first robustness check, I test whether the results are stable by changing the way ownership diversity is measured. To this end, the three diversity indices (i.e. the Simpson Index, Shannon–Wiener Index and Heip Index) are employed, calculating them relative to the deposit market. Looking at both the asset and funding sides of banks' balance sheets is important, since there is evidence that the market shares of shareholder banks vis-à-vis stakeholder banks may differ depending on whether the loan or deposit market is considered (Michie and Oughton, 2013). This is also confirmed by the values reported in Table 4.2, which point to some important differences in the degree of ownership diversity across the sample countries according to market type. A case in point is Switzerland, where the ownership composition of the banking system seems to be considerably more diverse if the loan side rather than the deposit side is considered (e.g. 2.087 and 1.570, respectively, when ownership diversity is measured by the Simpson Index). The results of this exercise are presented in Table 4.5. The coefficients on the variables of interest are highly significant and qualitatively similar to those presented in Table 4.4, leaving the findings virtually unaffected.[22]

A further concern is that my baseline setup might not control for other variables that could explain bank risk. For this reason, Equation 4.8 is re-run by including three additional explanatory variables one by one. First, I account for the ratio

[22]In unreported regressions, I use indices of ownership diversity that are constructed with data on either total assets or customer deposits (instead of total deposits). The results, not tabulated to save space but available on request, are again confirmed.

Table 4.5 Robustness Check: Alternative Measure of Ownership Diversity

	Dependent variable: Z-score (Z)		
Independent variable	Simpson Index	Shannon–Wiener Index	Heip Index
Lagged Z	0.919***	0.923***	0.936***
	(0.027)	(0.029)	(0.026)
TR	0.021***	0.020***	0.017***
	(0.006)	(0.007)	(0.006)
SIM_D	0.380***		
	(0.141)		
TR × *SIM_D*	-0.014***		
	(0.002)		
SHA_D		0.308**	
		(0.133)	
TR × *SHA_D*		-0.016***	
		(0.002)	
HEI_D			0.591***
			(0.222)
TR × *HEI_D*			-0.032***
			(0.004)
Bank-level controls			
STAKE	0.188***	0.145**	0.162***
	(0.042)	(0.060)	(0.041)
SIZE	0.018*	0.026**	0.020*
	(0.011)	(0.012)	(0.011)
LIQ	0.002**	-0.001	0.002**
	(0.001)	(0.002)	(0.001)
LEV	-0.010***	-0.010**	-0.007**
	(0.004)	(0.004)	(0.003)
ROE	0.006**	0.006**	0.007***
	(0.002)	(0.003)	(0.002)
DIV	-0.027	0.086	0.026
	(0.064)	(0.077)	(0.066)
Country-level controls			
CONC	0.011***	0.010***	0.010***
	(0.001)	(0.001)	(0.001)
ACT	0.044***	0.040***	0.042***
	(0.007)	(0.007)	(0.007)
CAPR	-0.015**	-0.008	-0.009
	(0.008)	(0.008)	(0.010)
SUP	-0.027***	-0.027***	-0.024***
	(0.004)	(0.004)	(0.004)
PRIV	-0.052***	-0.055***	-0.050***
	(0.009)	(0.010)	(0.009)
GDP	0.013***	0.015***	0.013***
	(0.003)	(0.003)	(0.003)
MKT	0.001**	0.001**	0.001***
	(0.000)	(0.000)	(0.000)
# of observations	40088	40088	40088
# of instruments	58	58	58

Table 4.5 *(Continued)*

	Dependent variable: Z-score (Z)		
	Simpson Index	Shannon–Wiener Index	Heip Index
Wald χ^2 (p-value)	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000
$AR(2)$	0.443	0.637	0.720
Hansen χ^2 (p-value)	0.106	0.207	0.136

Notes: The table presents the results of the empirical estimations with ownership diversity calculated for the deposit market. Z is a proxy for distance from insolvency; TR are the residuals from a regression of the overnight rate on GDP growth and inflation; SIM_D is the Simpson Index of ownership diversity for deposits; SHA_D is the Shannon–Wiener Index of ownership diversity for deposits; HEI_D is the Heip Index of ownership diversity for deposits; $STAKE$ is a dummy that equals 1 for stakeholder banks and 0 otherwise; $SIZE$ is the natural logarithm of real total assets; LIQ is the ratio of liquid assets to total assets; LEV is the ratio of liabilities to total assets; ROE is the Return On Equity; DIV is a measure of asset diversification; $CONC$ is the share of assets of the three largest banks in the country; ACT is an index of the regulatory restrictiveness on bank activities; $CAPR$ is an index of the stringency of bank capital regulations; SUP is an index of the power of the official supervisory agency to change bank behaviour; $PRIV$ is an index of the incentives for private investors to monitor banks; GDP is the annual growth rate of real GDP; MKT is the annual change in real stock market returns for non-financial corporations; Wald χ^2 (p-value) is the Wald χ^2 test of overall model fit; $AR(1)$ is the Arellano–Bond test for first-order serial correlation; $AR(2)$ is the Arellano–Bond test for second-order serial correlation; Hansen χ^2 (p-value) is the Hansen test of overidentifying restrictions. All regressions are estimated with the two-step system GMM for dynamic panels and include country- as well as time-specific effects. Windmeijer (2005) finite-sample corrected standard errors (clustered by bank) are reported in parentheses. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

of customer deposits to total assets as a proxy for franchise value (FRA).[23] Given that the cost of failure to owners will be greater for financial intermediaries with higher charter value (Fortin et al., 2010; Sullivan and Spong, 2007), one may posit that an increase in franchise value will discourage risk taking on the part of banks. Second, I account for the relative importance of banks in the country's financial system (IMP), estimated as the ratio of domestic credit provided by banks to GDP.[24] Insofar as financial intermediaries in more bank-based economies take on higher risk in an attempt to meet the more inelastic demand for credit by the private sector (Delis and Kouretas, 2011), I anticipate a negative link between the proxy for the relative importance of banks and their distance from insolvency. Third, a measure of institutional quality ($INST$) is added, namely the *Index of Economic*

Freedom by the Heritage Foundation. In line with the literature (Beck et al., 2006; Williams, 2014), one would expect improved national governance to result in greater bank stability. Table 4.6 presents the results of the panel estimations when these factors are included. Consistent with a priori expectations, there is evidence that franchise value plays a disciplining role in banks' risk decisions. At the same time, while intermediaries located in countries with a greater bank-credit-to-GDP ratio are generally characterised by relatively high levels of default risk, this paper finds somewhat limited support for a link between institutional quality and bank stability. After controlling for these additional influences, the results are not materially different from the baseline estimations and leave the conclusions unchanged.

[23]The data used to construct the measure of franchise value is collected from Bankscope.

[24]Data on the bank-credit-to-GDP ratio is gathered from the Global Financial Development Database (GFDD) maintained by the World Bank (Cihák et al., 2012).

Table 4.6 Robustness Check: Additional Control Variables

	Dependent variable: Z-score (Z)								
	Simpson Index			Shannon–Wiener Index			Heip Index		
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Lagged Z	0.970***	0.949***	0.953***	0.933***	0.898***	0.936***	0.941***	0.922***	0.904***
	(0.027)	(0.029)	(0.026)	(0.026)	(0.030)	(0.032)	(0.030)	(0.030)	(0.028)
TR	0.010**	0.021**	0.018***	0.010**	0.018**	0.017**	0.008**	0.015**	0.014***
	(0.005)	(0.009)	(0.006)	(0.005)	(0.008)	(0.008)	(0.004)	(0.007)	(0.005)
SIM_L	0.142*	0.430***	0.379**						
	(0.074)	(0.112)	(0.152)						
TR × *SIM_L*	-0.013***	-0.018***	-0.017***						
	(0.002)	(0.002)	(0.002)						
SHA_L				0.264***	0.279***	0.368*			
				(0.082)	(0.098)	(0.202)			
TR × *SHA_L*				-0.014***	-0.018***	-0.017***			
				(0.002)	(0.002)	(0.003)			
HEI_L							0.397***	0.312***	0.285***
							(0.110)	(0.118)	(0.107)
TR × *HEI_L*							-0.030***	-0.034***	-0.035***
							(0.004)	(0.005)	(0.004)
Bank-level controls									
STAKE	0.094**	0.137***	0.153***	0.138***	0.145***	0.120**	0.137**	0.119**	0.216***
	(0.043)	(0.046)	(0.040)	(0.045)	(0.056)	(0.059)	(0.056)	(0.057)	(0.061)
SIZE	0.033***	0.004	0.022**	0.031***	0.005	0.030**	0.042***	0.004	0.032***
	(0.011)	(0.012)	(0.011)	(0.012)	(0.012)	(0.013)	(0.011)	(0.013)	(0.010)
LIQ	-0.001	0.003***	0.002**	0.000	-0.001	-0.002	0.000	-0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LEV	-0.010**	-0.004	-0.007**	-0.010***	-0.009***	-0.011***	-0.009**	-0.008*	-0.011***
	(0.005)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.003)
ROE	0.008***	0.005**	0.008***	0.009***	0.008***	0.006***	0.010***	0.006***	0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
DIV	0.022	-0.022	0.014	0.012	0.038	0.119	0.046	0.016	0.044
	(0.063)	(0.067)	(0.067)	(0.071)	(0.076)	(0.075)	(0.077)	(0.077)	(0.076)

Table 4.6 *(Continued)*

	Dependent variable: Z-score (Z)								
	Simpson Index			Shannon–Wiener Index			Heip Index		
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FRA	0.001*			0.001**			0.001**		
	(0.001)			(0.000)			(0.001)		
Country-level controls									
CONC	0.007***	0.012***	0.012***	0.008***	0.010***	0.011***	0.008***	0.009***	0.007***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
ACT	0.026***	0.066***	0.038***	0.021***	0.061***	0.038***	0.036***	0.055***	0.038***
	(0.005)	(0.011)	(0.006)	(0.003)	(0.010)	(0.006)	(0.005)	(0.010)	(0.006)
CAPR	-0.005	0.005	-0.022***	0.004	0.007	-0.006	0.002	0.007	0.004
	(0.004)	(0.006)	(0.007)	(0.004)	(0.005)	(0.007)	(0.004)	(0.005)	(0.004)
SUP	-0.018***	-0.034***	-0.027***	-0.027***	-0.038***	-0.034***	-0.026***	-0.035***	-0.024***
	(0.003)	(0.005)	(0.005)	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)	(0.004)
PRIV	-0.031***	-0.066***	-0.047***	-0.057***	-0.071***	-0.058***	-0.051***	-0.064***	-0.048***
	(0.006)	(0.013)	(0.009)	(0.006)	(0.011)	(0.011)	(0.009)	(0.012)	(0.009)
GDP	0.014***	0.008***	0.016***	0.011***	0.009***	0.017***	0.014***	0.009***	0.016***
	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)
MKT	0.000*	0.000	0.001**	0.000	0.000	0.000	0.000*	0.000	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
IMP		-0.002***			-0.002***			-0.002***	
		(0.001)			(0.001)			(0.001)	
INST			-0.001			-0.001			-0.004**
			(0.002)			(0.002)			(0.001)
# of observations	39648	39502	40088	39648	39502	40088	39648	39502	40088
# of instruments	59	59	59	59	59	59	59	59	59
Wald χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$AR(1)$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
$AR(2)$	0.449	0.635	0.696	0.587	0.500	0.774	0.908	0.992	0.806
Hansen χ^2 (p-value)	0.171	0.238	0.120	0.088	0.288	0.086	0.151	0.148	0.353

Table 4.6 *(Continued)*

Notes: The table presents the results of the empirical estimations after the inclusion of additional control variables. Z is a proxy for distance from insolvency; TR are the residuals from a regression of the overnight rate on GDP growth and inflation; *SIM_L* is the Simpson Index of ownership diversity for loans; *SHA_L* is the Shannon–Wiener Index of ownership diversity for loans; *HEI_L* is the Heip Index of ownership diversity for loans; *STAKE* is a dummy that equals 1 for stakeholder banks and 0 otherwise; *SIZE* is the natural logarithm of real total assets; *LIQ* is the ratio of liquid assets to total assets; *LEV* is the ratio of liabilities to total assets; *ROE* is the Return On Equity; *DIV* is a measure of asset diversification; *FRA* is the ratio of customer deposits to total assets; *CONC* is the share of assets of the three largest banks in the country; *ACT* is an index of the regulatory restrictiveness on bank activities; *CAPR* is an index of the stringency of bank capital regulations; *SUP* is an index of the power of the official supervisory agency to change bank behaviour; *PRIV* is an index of the incentives for private investors to monitor banks; *GDP* is the annual growth rate of real GDP; *MKT* is the annual change in real stock market returns for non-financial corporations; *IMP* is the ratio of domestic credit provided by banks to GDP; *INST* is the *Index of Economic Freedom* by the Heritage Foundation; Wald χ^2 (p-value) is the Wald χ^2 test of overall model fit; $AR(1)$ is the Arellano–Bond test for first-order serial correlation; $AR(2)$ is the Arellano–Bond test for second-order serial correlation; Hansen χ^2 (p-value) is the Hansen test of overidentifying restrictions. All regressions are estimated with the two-step system GMM for dynamic panels and include country- as well as time-specific effects. Windmeijer (2005) finite-sample corrected standard errors (clustered by bank) are reported in parentheses. The superscripts *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

4.5 Conclusions

Since the outbreak of the global financial turmoil, many commentators have blamed the 'too-low-for-too-long' interest rates until the mid-2000s for the changes in risk perception by banks and the ensuing realisation of risks in the economy. In more recent years, a related debate has unfolded on whether continued expectations of a particularly low interest rate environment are already laying the foundation for the next financial crisis (Dell'Ariccia et al., 2013). This paper contributes to a fast-growing strand of research that endeavours to uncover the role of diversity within the banking sector in fostering the stability of the financial system and its resilience to crises (e.g. Ferri et al., 2014; Groeneveld and Llewellyn, 2012; Haldane and May, 2011). Borrowing measures used in ecology to capture the diversity of ecosystems, this article constructs indices of ownership diversity to examine how the ownership composition of the banking system affects monetary policy transmission via the risk-taking channel. The results, based on a large panel of shareholder and stakeholder banks operating in Western Europe, suggest that ownership diversity buffers the impact of unexpected monetary policy shocks on bank risk. In addition, this study finds that—ceteris paribus—banks located in countries with greater diversity of ownership forms tend to be more stable than their counterparts from less diverse markets. These results, which suggest that a higher presence of stakeholder banks in the system has a bearing on the risk decisions of shareholder banks, hold across several econometric specifications and point to the stabilising role played by ownership diversity in modern financial systems. By providing novel insights into the implications of the financial system architecture for systemic stability, my findings concur with the benefits that could be gained from a critical mass of stakeholder banks operating alongside shareholder banks (Ayadi et al., 2010; Llewellyn, 2012; Michie, 2011). As the Quantity Theory of Credit (Werner, 1993, 1997, 2005, 2012) predicts, a financial system populated by a large number of not-for-profit banks—which tend not to extend credit for non-GDP, speculative transactions—is likely to

deliver sustainable growth and to reduce the occurrence of asset bubbles.

The results of this paper have a number of implications for monetary authorities and other banking regulators. One of the major lessons from the empirical analysis is that ownership diversity emerges as an important factor accounting for differential effects of monetary policy on bank riskiness. For this reason, my evidence calls for a closer overseeing by central banks of the ownership composition characterising banking systems, as this is likely to moderate monetary transmission through the risk-taking channel. Moreover, the findings of this study are of interest to banking regulators, inasmuch as they feed into the current debate over how to design a more stable and resilient financial system (Casu and Gall, 2016; Llewellyn, 2017; Werner, 2016). In light of the positive link between ownership diversity and bank stability, regulators should ensure that the key attributes of stakeholder banks are not undermined by regulatory initiatives directed at and formulated for their shareholder counterparts. It follows that preserving a multiplicity of ownership types in banking might be viewed as an important policy objective. On this front, my findings concur with the view that countries where stakeholder-oriented institutions play only a marginal role might benefit from developing a network of such institutions, for example via the creation of municipality-owned banks and local cooperative banks (Werner, 2010, 2013a,b). For such an objective to be achieved, competition between different types of banks (rather than between banks of the same type) could be encouraged and the market shares on the loan and deposit sides of banks' balance sheets could be distributed more evenly across ownership forms. At the same time, the attainment of a more diverse banking system hinges on the ability of regulatory authorities to measure, monitor and report the degree of ownership diversity in the banking system. I hope that this paper will contribute further to the development of such an agenda.

Future research can extend my work in a variety of ways. In light of the important role played by stakeholder banks in offsetting shocks to the credit supply

of their shareholder peers (Ferri et al., 2014; Meriläinen, 2016), one would expect interactions between financial intermediaries with different forms of ownership to influence monetary policy transmission through banks' loan supply. Therefore, efforts might be directed at exploring the extent to which the degree of ownership diversity in the banking industry moderates the transmission of monetary policy via the bank lending channel (Bernanke and Blinder, 1988, 1992). In a similar vein, researchers could use the diversity indices proposed in this paper and examine how the ownership composition of the banking system interacts with banking regulations in determining the risk appetite of banks. By expanding on the literature concerned with the implications of ownership structure for the relationship between regulatory changes and bank risk (Laeven and Levine, 2009), these studies might shed new light on the factors explaining the differential impact of regulations (e.g. capital requirements, deposit insurance and activity restrictions) on risk-taking incentives by banks. Furthermore, an interesting extension of my work would be to incorporate spatial information into the analysis of ownership diversity. To this purpose, future research could build on insights from ecology (e.g. Rajala and Illian, 2012) and derive spatial indices of ownership diversity that can serve as valuable instruments in banking research. I am currently looking at how the spatial configuration of banks within and between bank types affects their appetite for risk and ensuing response to fluctuations in monetary policy.

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Appendix C

Table C.1 Correlation Matrix

	Z	*TR*	*SIM_L*	*SHA_L*	*HEI_L*	*STAKE*	*SIZE*	*LIQ*	*LEV*	*ROE*	*DIV*	*CONC*	*ACT*	*CAPR*	*SUP*	*PRIV*	*GDP*	*MKT*
Z	1.000																	
TR	0.032	1.000																
SIM_L	0.332	0.096	1.000															
SHA_L	0.353	0.093	0.984	1.000														
HEI_L	0.351	0.093	0.977	0.990	1.000													
STAKE	0.440	0.059	0.363	0.397	0.401	1.000												
SIZE	−0.155	−0.016	−0.087	−0.125	−0.128	−0.240	1.000											
LIQ	−0.237	−0.029	−0.226	−0.231	−0.241	−0.444	0.002	1.000										
LEV	0.086	0.052	0.241	0.232	0.229	0.263	0.284	−0.255	1.000									
ROE	0.005	0.012	−0.144	−0.150	−0.143	−0.153	0.099	0.081	0.016	1.000								
DIV	0.073	0.044	0.231	0.231	0.224	0.198	−0.029	0.044	0.122	−0.083	1.000							
CONC	−0.097	−0.057	−0.442	−0.480	−0.451	−0.222	0.049	−0.029	−0.140	0.075	−0.340	1.000						
ACT	−0.234	−0.020	−0.522	−0.464	−0.464	−0.090	−0.018	0.059	−0.170	0.114	−0.115	0.035	1.000					
CAPR	0.097	−0.064	0.241	0.214	0.188	−0.018	0.129	−0.038	0.062	−0.004	−0.078	0.174	−0.400	1.000				
SUP	0.046	−0.093	0.216	0.216	0.196	−0.041	−0.007	−0.047	0.054	−0.029	−0.112	0.197	−0.276	0.463	1.000			
PRIV	0.038	−0.018	−0.125	−0.133	−0.126	0.018	0.103	−0.047	−0.034	−0.056	0.006	0.101	0.056	0.108	−0.280	1.000		
GDP	0.022	0.058	−0.035	−0.055	−0.046	−0.082	−0.005	0.086	0.006	0.150	−0.045	0.036	0.008	−0.030	−0.060	−0.149	1.000	
MKT	0.041	−0.202	0.051	0.041	0.043	0.024	−0.012	−0.031	0.003	0.085	0.011	−0.001	0.137	−0.030	−0.174	0.057	0.585	1.000

Notes: The table shows the correlation coefficients for the main regression variables. *Z* is a proxy for distance from insolvency; *TR* are the residuals from a regression of the overnight rate on GDP growth and inflation; *SIM_L* is the Simpson Index of ownership diversity for loans; *SHA_L* is the Shannon–Wiener Index of ownership diversity for loans; *HEI_L* is the Heip Index of ownership diversity for loans; *STAKE* is a dummy that equals 1 for stakeholder banks and 0 otherwise; *SIZE* is the natural logarithm of real total assets; *LIQ* is the ratio of liquid assets to total assets; *LEV* is the ratio of liabilities to total assets; *ROE* is the Return On Equity; *DIV* is a measure of asset diversification; *CONC* is the share of assets of the three largest banks in the country; *ACT* is an index of the regulatory restrictiveness on bank activities; *CAPR* is an index of the stringency of bank capital regulations; *SUP* is an index of the power of the official supervisory agency to change bank behaviour; *PRIV* is an index of the incentives for private investors to monitor banks; *GDP* is the annual growth rate of real GDP; *MKT* is the annual change in real stock market returns for non-financial corporations.

Chapter 5

Conclusions

5.1 Summary of Research Findings

This thesis set out to shed new light on the role of banks within the context of monetary policy transmission by exploring how ownership structure affects monetary transmission via the risk-taking channel. The study of monetary transmission through financial intermediaries is important from both an academic and policy viewpoint, since intermediaries play a key function in linking monetary intervention to real economic outcomes. The implications of bank behaviour for real growth have also become apparent in the aftermath of the global financial crisis, which has led to a growing interest in understanding how risk-taking incentives by financial intermediaries are shaped by the monetary conditions prevailing in the economy. My thesis joins this discussion by bringing concepts from the ownership structure literature into the investigation of the risk-taking channel. To deliver the overall aim of the work, this manuscript addresses the three research objectives specified in Section 1.2 through a series of distinct studies in the format of journal articles.

The first study aims to develop an integrated view of the role of financial intermediaries as conduits for monetary policy transmission by carrying out a systematic review of the related literature. In doing so, it delineates the boundaries of the whole thesis and identifies some important gaps in existing knowledge. Drawing on the principles underpinning the Systematic Literature Review (SLR) methodology (Counsell, 1997; Tranfield et al., 2003) and a final sample of 152 peer-reviewed journal articles published over the 1963–2016 period, this paper surveys the extant literature to discern what is known about the mechanisms through which monetary

policy is transmitted to the real economy via financial institutions and the conditions that determine the functioning of these mechanisms. The review uncovers a multifaceted role of financial intermediaries as mediators between central bank intervention and economic performance. A key finding is that the reaction of financial institutions to variations in monetary policy has a bearing not only on economic outcomes, but also on the stability of the financial system. At the same time, the findings show that only recently has the link between monetary conditions and financial stability started to attract considerable attention by researchers, following the pioneering contribution on the risk-taking channel of monetary transmission advanced by Borio and Zhu (2012). As the review indicates, a major gap in the literature pertains to the implications that ownership structure has for the relationship between monetary policy and bank risk. This is the gap that is addressed in my second and third papers.

The purpose of the second study is to reconsider the role of stakeholder banks in monetary economics by investigating how bank ownership influences monetary policy transmission via the risk-taking channel. By constructing an unbalanced panel of commercial, cooperative and savings banks operating in 17 Western European countries over the period from 1999 to 2011, this paper finds robust evidence that the risk appetite of banks with alternative ownership types responds differently to fluctuations in monetary policy. Whilst shareholder banks tend to alter the riskiness of their portfolios more actively over the business cycle, the findings suggest that the impact of lower interest rates on systemic risk is reduced by the presence of stakeholder banks. Further analysis for the years before and after the outbreak of the global financial crisis reveals that the effects of monetary conditions on commercial banks' risk taking are stronger during the period preceding the bankruptcy of Lehman Brothers in the third quarter of 2008. In contrast, there is evidence that cooperative and savings banks follow less procyclical risk-taking policies compared to their commercial counterparts. In fact, this paper shows that the risk appetite

of stakeholder banks tends to be more stable relative to shareholder banks, over the business cycle. This finding emphasises the important role of cooperative and savings banks as vehicles for monetary policy transmission even at times of financial distress.

The third study extends the findings of my second paper by joining a rapidly growing strand of literature that is concerned with the implications of diversity in the banking sector for the stability of the financial system and its resilience to crises (Ayadi et al., 2010; Ferri et al., 2014; Llewellyn, 2012). Borrowing proxies from diversity of ecosystems within the field of ecology (Heip, 1974; Shannon and Weaver, 1949; Simpson, 1949), this article derives indices of ownership diversity to examine how the interactions between banks with different ownership structures affect the risk-taking channel. My findings, based on a large sample of shareholder and stakeholder banks located in Western Europe, show that ownership diversity buffers the effects of unexpected monetary policy shocks on banks' probability of default. This evidence implies that monetary transmission through the risk-taking channel is less pronounced in countries where the composition of the banking system tends to be more diverse. Furthermore, this paper finds that—ceteris paribus—banks operating in countries with greater diversity of ownership types have, on average, a lower appetite for risk than those located in less diverse countries. These findings, which hold across various econometric specifications and imply that a higher presence of stakeholder banks has a bearing on the risk-taking activities of shareholder banks, point to ownership diversity as a statistically and economically significant factor moderating the impact of monetary policy on bank riskiness.

5.2 Contribution to Knowledge

Collectively, the findings of the three studies included in this thesis contribute to existing knowledge in a number of important ways. These can be described at the theoretical, methodological and empirical levels.

From a theoretical perspective, this thesis contributes to the fast-growing line of research around the link between monetary policy and banks' appetite for risk (Ioannidou et al., 2015; Jiménez et al., 2014; Maddaloni and Peydró, 2013). By showing that financial intermediaries tend to adjust their risk exposure in response to changes in monetary conditions, my findings are consistent with the theoretical underpinnings of the risk-taking channel of monetary transmission (Borio and Zhu, 2012; Rajan, 2006). At the same time, my work extends this strand of research by bringing some of the key tenets of the ownership structure literature (Alchian and Demsetz, 1972; Jensen and Meckling, 1976) into the analysis of the monetary policy–bank risk nexus. Furthermore, this study speaks to the current debate over how to design a more stable and resilient financial system (Casu and Gall, 2016; Llewellyn, 2017; Werner, 2016). By estimating the ownership composition of the banking industry in terms of relative market shares of shareholder banks vis-à-vis stakeholder banks, this thesis shows how some of the central concepts from ecological theories can be used to predict financial intermediaries' behaviour. Importantly, it also illustrates the financial and economic benefits that might arise from a multiplicity of ownership types in the banking sector. Such evidence lends further support to the argument that a financial system populated by a variety of ownership structures, business models and corporate objectives is likely to be more stable and resilient to crises than one where a single model dominates (Ayadi et al., 2009; Groeneveld, 2012; Haldane and May, 2011). It follows that my findings confirm predictions from the Quantity Theory of Credit (Werner, 1993, 1997, 2005, 2012), while adding to earlier evidence on the contribution of diversity in banking to a series of other outcomes such as financial inclusion, competition and customer choice (Michie, 2011).

At the methodological level, this study is the first, to my knowledge, to systematically investigate the role of financial intermediaries as conduits for monetary policy transmission. It is also the first to assess theoretical, conceptual and empirical evidence on the micro-foundations of the monetary transmission process via finan-

cial institutions using the CIMO (Context, Intervention, Mechanism and Outcome) logic proposed by Denyer and Tranfield (2009). By means of a systematic review of the literature (Counsell, 1997; Tranfield et al., 2003), this thesis integrates and synthesises a highly fragmented body of knowledge to offer additional insights into the mechanisms of monetary transmission through financial institutions as well as the conditions underpinning the functioning of the individual mechanisms. Following this approach, this manuscript develops a multidimensional framework that may provide a more inclusive picture of how financial intermediaries' behaviour mediates the effects of central bank intervention on the real economy. Therefore, the findings of my research deepen our understanding of the monetary transmission process via financial intermediaries (Bernanke and Blinder, 1988; Kishan and Opiela, 2000; Kopecky and VanHoose, 2004). This framework also enables researchers to evaluate the extant evidence in a systematic manner and to reflect over some of the major gaps that exist in the related literature. By doing so, it lays the foundation for future quantitative and qualitative studies aiming at shedding further light on the role of financial institutions as vehicles for monetary policy transmission. Moreover, this thesis draws on insights from ecology and computes measures of ownership diversity for 17 Western European countries over the period from 1999 to 2011. The development of these measures allows to extend the work by Michie and Oughton (2013) and to contribute further to devising indices of ownership diversity that can serve as valuable instruments in banking research.

From an empirical standpoint, the findings from the econometric estimations indicate that the impact of lower interest rates on financial intermediaries' risk taking is diminished for cooperative and savings banks. This evidence corroborates recent findings from the literature (Ferri et al., 2014), which suggest that lending by stakeholder banks is generally less influenced by the monetary environment within which they operate compared to lending by shareholder banks. In submitting that the risk-taking incentives of cooperative and savings banks are more stable over the

business cycle than their commercial counterparts, this finding also concurs with the stream of research that finds support for a less cyclical behaviour by stakeholder banks (Meriläinen, 2016). In addition, this thesis finds that the effects of unexpected monetary policy shocks on banks' distance to default is reduced in countries with greater diversity of ownership structures. This finding, which points to the stabilising role played by ownership diversity in modern financial systems, complements existing studies on the implications of industry-related factors for the functioning of the risk-taking channel (Brissimis et al., 2014; Kick and Prieto, 2015). At the same time, since my sample period covers the global financial crisis alongside the eurozone sovereign debt crisis, this study redresses the paucity of evidence on the functioning of the risk-taking channel during times of adverse economic conditions. In this respect, a major contribution of my work refers to the finding that crisis episodes tend to make shareholder banks more risk averse and only marginally responsive to changes in conventional as well as unconventional monetary policy measures. Therefore, my research advances knowledge in the field by highlighting the need to account for differences in ownership structure when examining the implications of monetary policy for bank riskiness.

5.3 Implications

Besides contributing to knowledge, the findings of this thesis have a number of implications for practitioners and policymakers. The main implications are described in the next two sections.

5.3.1 Managerial Implications

A major takeaway for practitioners is that ownership structure is likely to shape the risk appetite of financial intermediaries in response to changes in monetary policy. For instance, the findings from the empirical analysis suggest that stakeholder banks tend to increase their risk exposure in an expansionary monetary environment to

a lesser extent compared to their shareholder peers. Such evidence may sensitise bank managers about how the risk-taking incentives at financial institutions are influenced by their type of ownership alongside the monetary conditions prevailing in the economy. This appears to be particularly important in light of the support found by this thesis for a statistically and economically significant relationship between monetary policy and bank risk taking. On this front, richer insights into how the interplay between monetary policy and ownership structure affects banks' appetite for risk may be of specific interest to the management of cooperative financial institutions that are considering processes of voluntary conversion to limited company status. In fact, my findings imply that a change in business objectives (e.g. from stakeholder value creation to shareholder wealth maximisation) may alter the incentives on the part of financial institutions to take on risk in response to variations in monetary policy. If effective risk management techniques are not adopted, financial intermediaries may end up taking excessive risk onto their balance sheets with potentially negative consequences in terms of their financial health and probability of survival. Furthermore, what is still largely hidden from the debate over the role of financial intermediaries in monetary policy transmission is that this and other related phenomena are ultimately explained by the strategies and actions of organisational agents. For this reason, the findings of my research may also encourage greater awareness on the part of practitioners with respect to the impact that their risk decisions have on the stability of the financial system and its resistance to external shocks. This means that the consequences of their behaviours for the overall system may become more transparent and easier to predict. In addition, a key implication that this study has for bank managers pertains to the identification of a set of factors that may allow financial institutions to shield their balance sheets from variations in monetary policy. A case in point is the finding that banks that make use of securitisation activity and establish long-term relationships with their customers (e.g. via relationship lending) are generally better able to insulate their

loan supply from changes in the interest rate environment. This may have positive effects on their financial performance, especially during periods of more volatile interest rates.

5.3.2 Policy Implications

The findings of this thesis bear important implications for monetary authorities and other banking regulators. A key lesson from the systematic review of the literature and the empirical analysis is that monetary policy indeed affects the risk-taking incentives of financial intermediaries and—as a result—the stability of the financial system. Therefore, my evidence calls for greater responsibilities on the part of monetary authorities in terms of macroprudential regulation and supervision, for example via the establishment of independent bodies such as the European Systemic Risk Board (ESRB) to monitor systemic risk. Furthermore, the empirical findings suggest that diversity of ownership structures in the banking sector is likely to moderate monetary policy transmission through the risk-taking channel. It follows that measures capturing the ownership composition of the banking system should be accounted for in the central bank's reaction function. At the same time, this study indicates that it might be systemically beneficial to have a banking sector populated by a critical mass of stakeholder banks vis-à-vis shareholder banks. This evidence implies that encouraging a multiplicity of ownership types in banking might be regarded as an important policy objective, thereby contributing to the ongoing discussion about the link between bank ownership and financial stability (Ayadi et al., 2010; Casu and Gall, 2016; Groeneveld and Llewellyn, 2012). For this objective to be attained, policymakers could ensure that the specific features of cooperative and savings banks are not weakened by regulatory restrictions directed to and devised for their commercial counterparts. On this front, the findings of my research speak to the current debate over the role of proportionality in banking regulation (Llewellyn, 2017), in that they tend to emphasise the need for sufficient differentiation in the

application of regulation based on—among others—ownership structures, business models and risk profiles. In addition, it might be argued that regulators should ensure that competition between different types of banks (rather than between banks of the same type) is promoted and that the market shares on the loan and deposit sides of banks' balance sheets are distributed more evenly across ownership types. In this respect, this thesis advances the argument that countries in which stakeholder-oriented institutions play only a minor role might benefit from developing a network of such institutions, for example via the creation of municipality-owned banks and local credit unions (Werner, 2013). Importantly, it also implies that the achievement of a more diverse banking industry rests on the ability of policymakers to evaluate, monitor and disclose the degree of ownership diversity characterising the banking system. To this end, diversity indices used in the field of ecology—such as the ones developed in this thesis—may represent valuable instruments.

5.4 Research Impact and Dissemination

As Sections 5.2 and 5.3 illustrate, this thesis has important implications both within and outside the academic world. To ensure that my findings reach fellow researchers, practitioners and policymakers alike, I have made specific efforts to disseminate my research soon after starting my PhD. By working closely with my ever-supportive supervisor, Dr Catarina Figueira, I have presented my work at Doctoral Colloquia at Cranfield School of Management and at leading international conferences, such as the International Finance And Banking Society (IFABS) Conference in Spain, the European Financial Management Association (EFMA) Annual Meeting in Switzerland and the International Workshop on Financial System Architecture and Stability (IWFSAS) in Canada. The findings of my research have also been disseminated through a series of invited talks, including seminars organised by the International Research Centre on Cooperative Finance (IRCCF) at HEC Montréal and by the Center for Relationship Banking and Economics (CeRBE) at LUMSA University.

Moreover, I have been committed to making an impact on the business and policy communities by sharing my findings with practitioners and policymakers. Among the guest lectures that I have delivered is a speech at the European Parliament in Brussels, in which I have discussed the implications of ownership structure for financial intermediaries' risk taking and monetary policy transmission. On this occasion, my work has also been granted the 4th European Association of Cooperative Banks (EACB) Award for Young Researchers on Cooperative Banks. In addition, the research reported in this thesis has received a Mobility Award from Santander Universities to fund my attendance at the EFMA 2016 Annual Meeting and a Best Paper Award by the Centre for Sustainable and Social Innovation (CSSI) at the University of Victoria as part of the IWFSAS 2016. One paper originating from my PhD work is at the Revise and Resubmit stage in the *Journal of International Financial Markets, Institutions and Money* (ABS: 3), while two other papers have been submitted to the *Economic Journal* (ABS: 4) and to the *IMF Economic Review* (ABS: 3). A detailed list of my academic papers, awards and presentations throughout my registration period is included in Appendix Table D.1.[1]

5.5 Limitations

Despite enriching knowledge about the role of banks in monetary policy transmission, this thesis is subject to some limitations. Since the empirical analysis is based on a sample of Western European countries, caution should be exercised when generalising the findings and conclusions of this study. For example, it is important to bear in mind that the majority of the countries covered in the analysis have bank-based financial systems, that is, systems in which banks serve a central function in mobilising savings, allocating capital, overseeing investment strategies of non-financial firms and offering risk management services (Demirgüç-Kunt and Levine, 1999). Further evidence is needed to verify the extent to which the findings about

[1] A reflection on my personal development during my PhD is presented in Appendix E.

the moderating impact of ownership structure on the risk-taking channel of monetary transmission apply to countries with market-based financial systems (e.g. the US). Furthermore, there are several limitations associated with the data employed in the econometric estimations. Ideally, credit risk should be captured by the ratio of non-performing loans to total loans as a more direct measure of loan quality (Delis and Kouretas, 2011). However, data on non-performing loans is only available for a limited number of all the banks included in the sample (mostly from Italy). Another potential concern relates to the use of annual instead of quarterly data, which might not allow for a full identification of the effects of monetary policy on bank risk taking (Brissimis et al., 2014). Although the validity of resorting to annual data when examining the risk-taking channel finds support in the literature (Delis and Kouretas, 2011), it would be worth enquiring into the robustness of the findings should more balance sheet and income statement data for unlisted banks become available at the quarterly level. Additionally, the novel insights provided by this thesis into the link between diversity in banking and financial stability could be supplemented by expanding the sample period beyond 2011, as this would further enhance our understanding of the functioning of the risk-taking channel during times of financial distress.

5.6 Suggestions for Future Research

By integrating predictions from the property rights (Alchian and Demsetz, 1972) and agency theory (Jensen and Meckling, 1976) perspectives into the analysis of the risk-taking channel, this thesis opens up new and promising avenues for future research.

A first line of enquiry would be to complement the findings of this study by offering deeper insight into the implications of ownership diversity for the bank lending channel of monetary transmission (Bernanke and Blinder, 1988, 1992). As the literature suggests (Ferri et al., 2014), stakeholder banks tend to smooth finan-

cial conditions for their customers by curtailing their loan supply to a lesser extent than shareholder banks following a contractionary monetary policy. This notwithstanding, hardly any studies have endeavoured to investigate how the interactions between banks with different types of ownership influence monetary transmission via the bank lending channel. Such a void is surprising, given that existing evidence on the role of cooperative and savings banks in counteracting shocks to the credit supply of their commercial counterparts (Meriläinen, 2016) seems to imply that the ownership composition of the banking system is likely to affect the relationship between monetary policy and banks' lending decisions. For this reason, I would encourage researchers to examine the extent to which ownership diversity in banking has a bearing on the functioning of the bank lending channel. To this purpose, researchers could build on the diversity indices that are presented in this thesis and collect data for a sample of shareholder and stakeholder banks located both within and outside Western Europe. By doing so, these studies would also add to the somewhat limited knowledge of the impact that a multiplicity of ownership structures in banking has on monetary policy transmission in non–Western European economies.

A second research avenue that arises organically out of my work would entail the inclusion of spatial information into the analysis of ownership diversity. Although the indices that are developed as part of this thesis allow to quantify the degree of ownership diversity in the banking industry, they do not account for the spatial configuration of banks within and between bank types. To move the analysis one step further, researchers could borrow from the field of ecology (e.g. Rajala and Illian, 2012) and construct spatial indices of ownership diversity that would be of great value for banking research. Broadly speaking, these indices could be employed by future studies dealing with the implications of diversity in banking for a number of financial and economic phenomena. For instance, such measures would enable researchers to explore how the ownership composition of the banking system inter-

acts with banking regulation in shaping banks' appetite for risk. By contributing to the literature that addresses the moderating role of ownership structure in the relationship between regulatory changes and bank riskiness (Laeven and Levine, 2009), this work would shed new light on the factors underpinning the differential effects of regulation on financial intermediaries' risk taking. At the same time, findings from this strand of research would have important implications from a policy standpoint. Since the attainment of a more diverse banking sector hinges on the ability of regulators to measure, monitor and report the degree of ownership diversity in banking (Michie and Oughton, 2013), this research would equip regulatory authorities with sound and viable measures through which this objective could be effectively pursued.

A third and interesting extension of my findings would be to link the literature around the risk-taking channel of monetary transmission with the studies on bank business models. Among these studies, which tend to show that balance sheet and income statement structures adopted by banks have an impact on their behaviour and performance (Altunbas et al., 2011; Ayadi et al., 2016; Mergaerts and Vander Vennet, 2016), particularly insightful for future research appears to be the contribution by Ayadi et al. (2016). By means of cluster analysis and an asset/liability approach, they find support for the existence of five business models in European banking, namely 'focused retail', 'diversified retail (type 1)', 'diversified retail (type 2)', 'wholesale' and 'investment'. Most importantly, the work by Ayadi et al. (2016) indicates that some business models are likely to be less stable and to generate more systemic risk than others, thereby influencing the stability of the financial system and its resilience to external shocks. Insofar as business models adopted by banks have a bearing on their stability and risk-taking incentives, one would expect the risk decisions of financial intermediaries with alternative business models to respond differently to changes in monetary policy. It follows that a fruitful way of taking my research forward would be to test the hypothesis that bank business models moderate monetary policy transmission via the risk-taking channel. It is envisaged that

this stream of literature would make an impact on both the business and policy communities, while contributing to the academic debate over the benefits of diversity in banking for the stability and resilience of the financial system.

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Appendix D

Table D.1 Research Dissemination

Year	Dissemination
Papers under review	
2017	Caselli, G. and Figueira, C., "The role of ownership diversity with respect to the risk-taking channel of monetary transmission", *Journal of International Financial Markets, Institutions and Money* (ABS: 3), R&R.
	Caselli, G. and Figueira, C., "Risk-taking channel of monetary transmission and financial stability: What role for stakeholder banks?", *Economic Journal* (ABS: 4), under review.
	Caselli, G. and Figueira, C., "Financial firms as vehicles for monetary policy transmission: A systematic literature review and future directions", *IMF Economic Review* (ABS: 3), under review.
Awards	
2016	Best Paper Award, Centre for Sustainable and Social Innovation (CSSI), University of Victoria.
	Santander Mobility Award, Santander Universities.
	4th EACB Award for Young Researchers on Cooperative Banks, European Association of Cooperative Banks (EACB).
Invited talks	
2017	Center for Relationship Banking and Economics (CeRBE) Research Seminars, LUMSA University, Rome, Italy.
2016	International Research Centre on Cooperative Finance (IRCCF) Internal Seminars, HEC Montréal, Montréal, Canada.
	EACB Academic Conference, European Parliament, Brussels, Belgium.
Conference presentations	
2016	Doctoral Colloquium, Cranfield School of Management, Cranfield, UK.
	4th European Conference On Banking And The Economy (ECOBATE), University of Winchester, Winchester, UK.
	International Workshop on Financial System Architecture and Stability (IWFSAS), University of Victoria, Victoria, Canada.
	European Financial Management Association (EFMA) Annual Meeting, University of Basel, Basel, Switzerland.
	6th International Conference of the Financial Engineering and Banking Society (FEBS), University of Málaga, Málaga, Spain.
	International Finance And Banking Society (IFABS) Conference, Universitat Autònoma de Barcelona (UAB), Barcelona, Spain.
	3rd Money, Macro and Finance (MMF) PhD Workshop, University of Birmingham, Birmingham, UK.
2015	PhD Conference in Monetary and Financial Economics, University of the West of England (UWE), Bristol, UK.
	Doctoral Colloquium, Cranfield School of Management, Cranfield, UK.

Appendix E

A Reflection on My Personal Development

As I approach the completion of my PhD, I am amazed at how much I have developed, changed and learned since I first joined the programme. Perhaps the best way to describe my personal development is that I embarked on my doctoral journey as a student and have now become a researcher. Looking back on my learning experience during the last four years, I can see an exponential curve in my critical thinking skills. My PhD has helped me become more critical, reflective and curious about what I read, while teaching me how to put the 'academic scepticism principle' into practice in anything I do. The opportunity to conduct and disseminate my research to a variety of audiences has benefited my communication skills (both written and verbal) substantially. With the relentless support of my supervisor, Dr Catarina Figueira, I have learned how to write academic papers and transfer my thoughts to paper in an effective manner. By delivering a number of invited talks, research seminars and conference presentations both nationally and internationally, I have also improved my presentation skills and gained more confidence in public speaking. This is one of the aspects that I have enjoyed the most during my PhD and that has also taught me the importance of maintaining academic networks with fellow colleagues from all around the world. To this regard, I have soon learned that there is much to be gained from exchanging ideas and collaborating with others, in contrast with the popular myth of PhD research as taking place in an 'ivory tower'. Importantly, I believe that my doctoral studies have equipped me with a sound knowledge and experience of the academic research process. Besides working towards my degree, I have had the opportunity to contribute to several research projects in areas such as risk taking by academics, migrant entrepreneurship and public-private partnerships in transitional economies. Some of these projects have already resulted in publications in refereed academic journals and books, including

Studies in Higher Education (ABS: 3) and *Society and Business Review* (ABS: 2). For all these reasons, I am confident that my PhD has prepared me well for a successful career in academia and I thus look forward to the next step in my professional journey.